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PICKERING NGS 'B' POSTOPERATIONAL RADIOTELEMETRY STUDIES, 1986 AND 1987

Report No 90-81-K

L.P. King
Survey Technician
Biological Research Section
Chemical Research Department

ABSTRACT

Radiotelemetry studies were conducted at Pickering NGS in 1986 and 1987 to address hypotheses of salmonid residency formulated at two environmental effects workshops in 1985. Eight round whitefish were radiotagged at Whitby during November, 1986. One whitefish remained in the study area for 13 days, but departed prior to the December spawning period. The study was not successful in locating a suspected round whitefish spawning ground near Whitby. An automated radiotelemetry receiving system was installed at Pickering NGS in September, 1987. Calibration experiments revealed that a tagged fish passing any of the four listening stations (Pickering A discharge, Pickering intake, Pickering B discharge and Pickering east boundary) at a distance of 500 metres and depth of 5 metres would be detected. Ten lake trout were tagged in October 1987. One trout returned twice, after intervals of 15 and 24 days absence, to spend approximately 2 and 24 hours respectively, within the reception zone of the listening stations. Two trout were captured by anglers, one in New York and the other in Ontario, and one succumbed to the stress of tagging. No further contact was made with the remainder. Five smallmouth bass tagged in the discharge channels of Pickering A and B stayed in their respective habitat. Bass appear to be periodic residents of the thermal plume during fall/winter.

job	file	date	report no.
34-185-492	837.321-PIC	May 22, 1990	90-81-K

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EXECUTIVE SUMMARY

PICKERING NGS 'B' POSTOPERATIONAL RADIOTELEMETRY STUDIES, 1986 AND 1987

L.P. King
Biological Research Section
Chemical Research Department

Radiotelemetry studies were conducted at Whitby and Pickering NGS in 1986 and 1987 as part of the Pickering NGS 'B' postoperational biological survey program. The hypotheses of effect being investigated included determining the exact location of suspected round whitefish spawning grounds at Whitby and determining the periods of thermal plume residency of fall spawning salmonids. In the latter case, extended periods of residency would affect sexual maturation of gonads, and hence spawning success. Extended residency near the station may also increase their vulnerability to angling. These studies were requested by the Environmental Studies and Assessments Department of the Design and Development Division-Generation on behalf of Pickering Engineering Department.

Eight mature round whitefish were radiotagged at Whitby in November 1986. One individual remained within the study area for 13 days, but the majority could not be located within 2 days of tagging. The final contact with a tagged whitefish was on November 27, which is well in advance of their customary spawning period of mid-December. Experiments with a reference transmitter revealed that the effective reception range was very limited beyond the seven metre depth contour. Later searching efforts were complicated by unfavourable weather conditions, while freeze-up of the local harbour (Whitby) forced cancellation of the study following December 15, 1986. The study was unsuccessful in locating a suspected round whitefish spawning ground in the vicinity of Whitby.

An automated radiotelemetry receiving system was installed at Pickering NGS in September, 1987. Individual receiving stations were established at Pickering A discharge, Pickering intake, Pickering B discharge and Pickering east boundary. Calibration experiments revealed that the minimum reception range at which a tagged fish would be consistently detected at any of the receiving stations was a distance of 500 metres and at a depth of 5 metres. Greater distances (maximum 1.45 km.) were attainable at shallower depths (1-2 m.) and at those stations furthest from the powerhouse. The system proved to be too fragile for the exposed environment at Pickering, resulting in data loss at 3 of 4 locations and damage to antennas at the highest energy locations. Encapsulation of computerized components of the system within water-proof housings provided normal operation during tests in Fall/Winter 1988.

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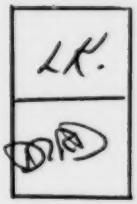
Ten lake trout were radiotagged in October, 1987. One did not survive the stress of tagging and washed up on the beach 8 days later. Eight left the vicinity of the station immediately after tagging and were not heard from again, with the exception of two which were caught by anglers (one in New York and one in Ontario). The last lake trout remained within the reception zone of the receiving system for approximately 40 minutes, then left, only to return again on two separate occassions, 15 and 24 days after tagging. The duration within the reception zone of the system on return visits ranged from 2 hours to 24 hours. Temperatures experienced by this trout on return visits ranged from 11.6-14.7°C, indicating passage through the outer mixing portion of the thermal plume. Results of this study, in conjunction with results of Floy tagging and netting studies, indicate that lake trout range widely throughout Lake Ontario and may come into contact with power station discharges in the course of their travels. They do not appear to exhibit any long term attraction to the thermal plume, but remain in the outer mixing area within the zone of their thermal preference. It is unlikely that the periods of offshore plume residency observed in this study would affect sexual maturation of prespawning adults.

Five smallmouth bass were radiotagged in the discharge channels of Pickering 'A' (3 bass) and 'B' (2 bass) during November, 1987. No interchange occurred between the individuals in the separate discharge channels. Although complete data loss occurred at Pickering A due to computer failure, partial records indicate residency periods ranged from 2 weeks to 2 months. Data obtained from the Pickering B receiving station indicate surprisingly similar patterns of discharge use for the two bass involved. Both fish alternated between 3 or 4 days presence, followed by 1 or 2 days absence during the initial 10 day period. After this, periods of absence increased in duration, until the final contact was made on December 10,1987. Temperature records indicate that bass prefer the inner, unmixed area of the discharge channel, rather than the offshore area preferred by lake trout. Smallmouth bass appear to be periodic residents of the thermal plume during fall/winter. The results of this study, combined with previous studies, indicate that bass utilize the discharge area year-round, but are only full-time inhabitants during the spring spawning period.



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TO: Dr. W.R. Effer
Manager
Environmental Studies & Assessments Dept
Design & Development Division - Generation

PICKERING NGS 'B' POSTOPERATIONAL RADIOTELEMETRY STUDIES, 1986 AND 1987

1.0 INTRODUCTION

A series of radiotelemetry studies were conducted in Lake Ontario during 1986 and 1987 as part of the Pickering NGS 'B' postoperational biological studies. These studies were requested by Environmental Studies and Assessments Department, Design and Development Division - Generation on behalf of the Pickering Engineering Department. The objectives of the program and hypotheses of station environmental effects were developed at two workshops conducted in April and May of 1985 (Greig et al, 1986). Round whitefish was identified as one of the "valued species" at these workshops. Previous studies conducted near Pickering NGS (Haymes and Kolenosky, 1984; OHRD Report No. 87-149-K, 87-181-K) had indicated that aggregations of spawning round whitefish were present at Thickson Point and Whitby West transects (near Whitby), but no direct observations of spawning behaviour or precise identification of spawning grounds had been made. This report documents an attempt made during the fall of 1986 to radiotag pre-spawning round whitefish with the objective of tracking them to their spawning areas.

Lake trout, as well as other salmonid species, frequent the discharge areas of the station more often during both spring and fall when elevated discharge temperatures are within their thermal preference (OHRD Report No 89-149-K). Two hypotheses developed at the scoping workshops that addressed the effects of plume residency were that salmonid numbers could decrease due to increased angling effort and that use of the thermal plume by pre-spawning salmonids could decrease their spawning success (Greig et al, 1986). In order to investigate these hypotheses, a radiotelemetry study was conducted in 1987 to determine the periods of residency of lake trout and brown trout within the thermal plume. As well, by utilizing temperature sensitive tags, the study would identify their preferred temperatures and monitor movements of trout in and out of the thermal plumes. This report also describes the installation and calibration of an automated radiotelemetry receiving system at Pickering NGS, and its subsequent use to assess the hypotheses of salmonid residency in the thermal plumes of Pickering NGS 'A' and 'B'.

Smallmouth bass were selected as an alternative species of study when it became apparent that brown trout were no longer available in sufficient quantities in the vicinity of the station by October. Previous tagging studies along the south shore of Lake Ontario (Haynes and Nettles,1983; Nettles et al., 1987) indicated that brown trout movement during fall was strongly influenced by their spawning behaviour. Prior to mid-October, adults showed a strong diurnal migration, moving offshore to deep water during the day and returning inshore to shallow water at night. By late October-November,

upstream spawning movement had occurred, followed by rapid offshore dispersal to deep water. Thus it was considered that brown trout resident along the north shore at Lake Ontario probably follow similar behavioural patterns and that little additional information would be gained by tagging them in mid-October, 1987. Smallmouth bass however, had been found to be a frequent inhabitant of the thermal discharge during spring and summer of 1987, with a major spawning event occurring within the confines of the Pickering NGS 'B' discharge channel (OHRD Report No. 88-267-K). Hence, smallmouth bass were chosen for study in October, 1987 in an effort to determine their residency period within the discharge channels of Pickering NGS 'A' and 'B' during the fall and winter months.

2.0 METHODS

2.1 Round Whitefish

Round whitefish were collected in a 6.1 m trap net set between Whitby harbour and Thickson Point as part of the 1986 Pickering post-operational study (OHRD Report No 87-194-K). Fish were removed from the trap net and transferred to individual 66 L holding tanks. They were then anesthetized in a dilute tricainemethane sulfonate (MS-222) solution, radio-tagged and returned to the holding tank. Radiotags equipped with a whip antenna, (Lotek Engineering Inc.), were externally mounted on the round whitefish in a side-saddle configuration as described by Haynes & Nettles (1983, Figure 1). Once the fish regained equilibrium, they were observed for a further 20-30 minute period of normal activity prior to release. Four individuals were tagged on each of two dates (November 12 and 25, 1986) and released approximately 1.5 km offshore, directly south of the Whitby harbour entrance in 12 m of water. External tags were selected over internal transmitters as prespawning adults could not accommodate a transmitter in a body cavity almost filled with mature gonads.

Although no measurements of fish length or weight were obtained, the largest individuals were selected from the trap net catch on each tagging day. Based on lengths and weights of other round whitefish captured at Whitby during November-December gill netting (OHRD Report in prep.), it is estimated that most individuals were 380-400 millimetres in length and averaged 800-1000 grams in weight. As radiotags were 15-20 grams (Lotek specifications), the tag to body weight ratio was very close to the limits suggested by other researchers (1.5% of fish body weight, Ross and McCormick, 1981).

Receiving equipment consisted of a AVM Model LA12 receiver and a 5 element YAGI antenna constructed according to specifications outlined in the Radio Amateur Handbook (ARRL 1982). Final SWR (Standing Wave Ratio) after adjustment was 1.3:1. The antenna was vertically mounted on a 6.7 m work boat where it was fixed along the longitudinal axis of the boat. This required rotating the vessel's heading from side to side while tracking, but allowed tracking to proceed during higher energy lake conditions than with a free moving antenna. Close quarter tracking was accomplished with a hand-held antenna. Offshore location fixing information was obtained with a SITEK Loran C Receiver. Measurements of water depth and observations of prominent shoreline features were recorded to supplement Loran C readings.

2.2 Automated Radiotelemetry Receiving System

Automated radiotelemetry receiving systems of various degrees of sophistication have been described in the literature since 1979 (Gray and Haynes, 1979; Ross et al., 1979; and Lemnell et al., 1983). An automated receiving system, developed by Cedar Creek Bioelectronics Laboratory (University of Minnesota), and in operation at Somerset generating station, New York, was examined in December, 1986, as a possible means of providing the required information on salmonid residency. This system consisted of a three antennae, hard wired, computer controlled network used to track salmonid

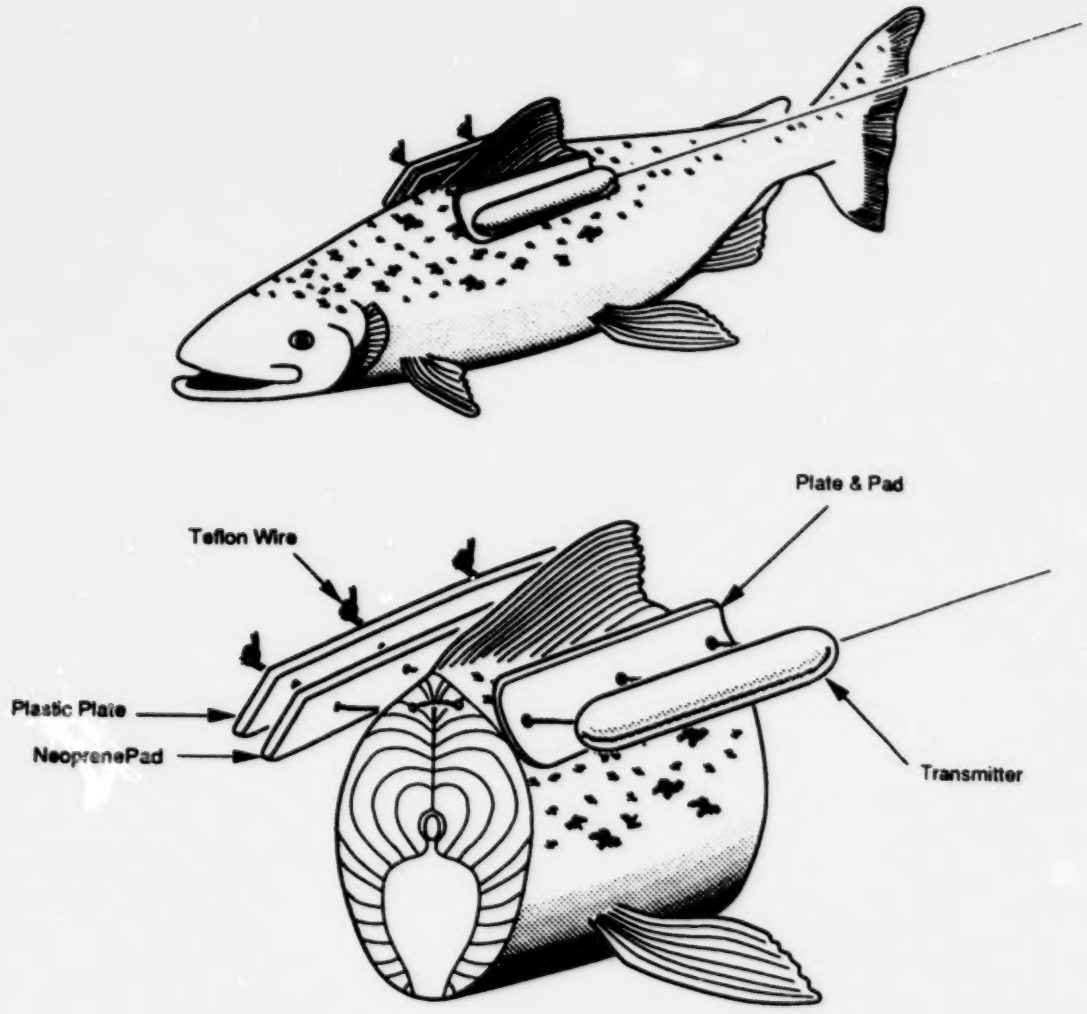

FIGURE 1

METHOD OF ATTACHMENT OF RADIO TRANSMITTERS (FROM HAYNES AND NETTLES, 1983)

residency near the submerged offshore discharge of Somerset power station (Haynes et al., 1988). The requirement that each antenna station be directly connected to the controlling computer however, limited the usefulness of this system for the conducted application at Pickering due to the distances involved and the physical barriers (intake and discharge channels, security fence) between locations. Further discussions with Cedar Creek Bioelectronics revealed that a totally independent, self-contained data collection unit was available which could be installed at each proposed listening station, thereby avoiding the problems associated with interconnected listening stations (on line static or noise, protection and maintenance of cables, cost of cables, etc.). This type of system was ordered for spring, 1987, with proposed testing and debugging prior to fall, 1987. Brown trout, which are more likely to remain near the station during spring and summer (OHRD 87-149-K), were targeted for a small scale study which was to have taken place following initial installation to assist in overall debugging of the system. Delays, however were encountered in ordering and delivery of the system, hence installation did not commence until late September, 1987.

Four listening stations were installed: one at each of Pickering 'A' Discharge, Pickering Intake, Pickering 'B' Discharge and Pickering East boundary (Figure 2). Each station consisted of the following components:

1) a Cedar Creek Scanning Receiver;
2) a Cedar Creek Data Collection Computer (DCC);
3) a 12 V deep cycle (RV type) battery;
4) a steel, weatherproof 2' x 2' x 2' enclosure for above equipment;
5) a 6.1 m 2 piece TV tower with 3 m mast;
6) an antenna rotator;
7) a Telex Hy-gain 4 element YAGI antenna (Model 64B-S); and
8) interconnecting power, signal and grounding cables as well as tower guy-wire system.

An individual station is shown in Figure 3. When all stations were established and operating, a series of calibration tests were conducted to establish the reception range (depth and distance) of individual stations.

A description of the operating system and the criteria used to accept valid data to memory is outlined below, followed by a description of the manner in which this was used to determine range limits for individual stations.

The data collection and storage components of the system consist of the Cedar Creek Telemetry Receiver and DCC (Data Collection Computer). The DCC is used to control the receiver, collect the data, apply limit conditions, store the data and transmit the data to a host computer. It is equipped with an RS-232 link for access to a host computer or remote terminal, as well as a separate link to the scanning receiver. The core of the DCC is the ROM based Basic Language interpreter "Tattletale" supplied by Onset Computer Corporation, of N. Falmouth, Mass. This version of the basic language was designed for speed of input/output and data collection functions. The DCC was supplied with a disk based operating system which was loaded from a host computer. The operating program controlled radio frequency selection and data collection. Scan rate was preset at 20 sec/frequency but could be adjusted from within the disk based operating system. The DCC has approximately 220 K bytes available for internal data storage. Power to the DCC is supplied by internal lithium batteries. A listing of the operating system program is included in Appendix 1 and a flow chart indicating relationship of individual components is shown in Figure 4.

The receiver listens for individual frequencies according to DCC instructions as well as other criteria which are listed below. Tags used in this study operated in the 50 mHz band, emitting signals that are typically pulsed on and off at a rate of 60-90 pulses per minute, with an on time of 20

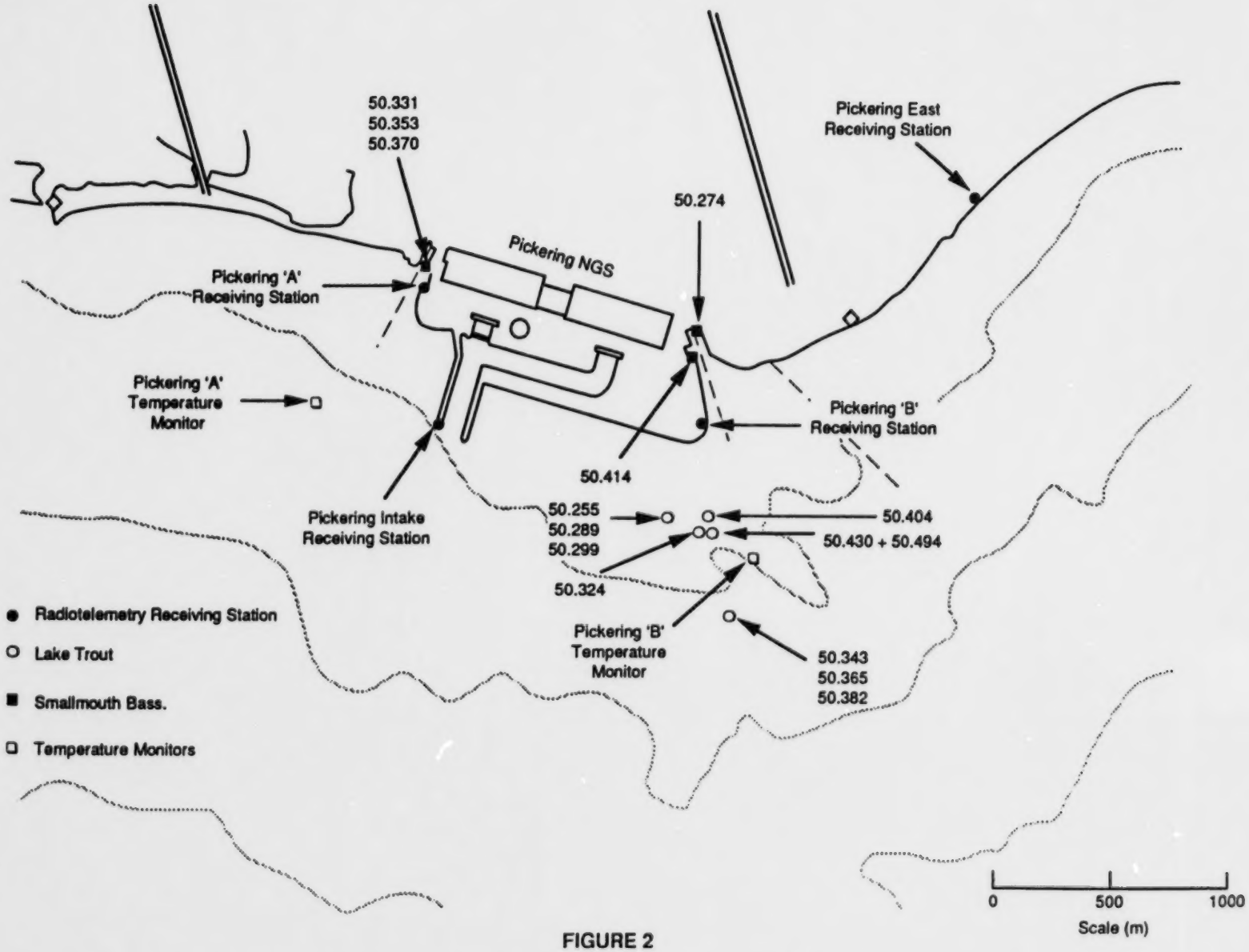

FIGURE 2

RADIOTELEMETRY RECEIVING STATIONS, TEMPERATURE MONITORS
AND LAKE TROUT AND SMALLMOUTH BASS RELEASE POINTS
PICKERING NGS, 1987

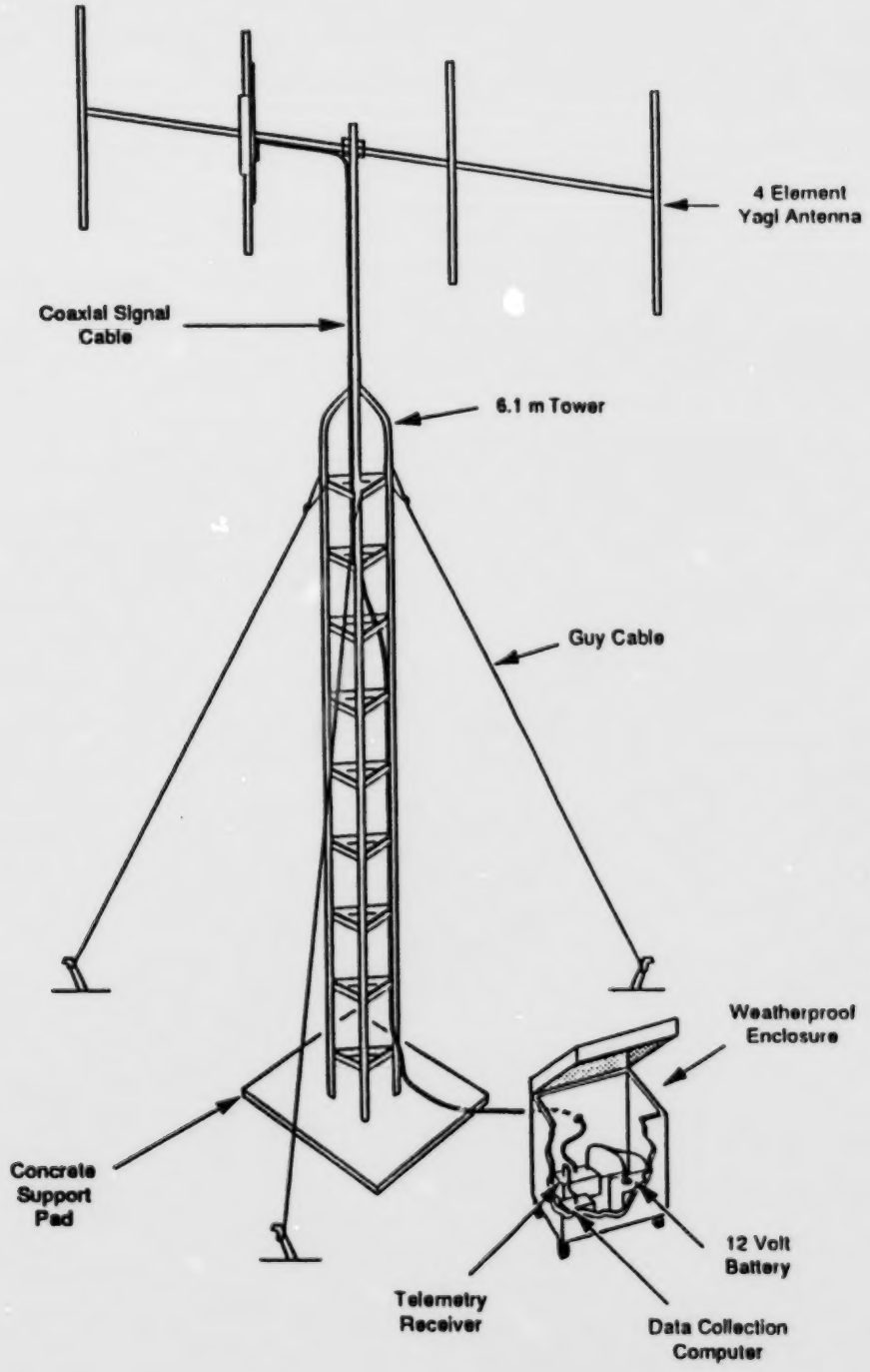

FIGURE 3

DIAGRAMATIC REPRESENTATION OF RADIOTELEMETRY RECEIVING STATION PICKERING NGS, 1987

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milliseconds. Pulse rate varies approximately linearly with temperature. As the transmitters come within proximity of a monitoring station, the signal can be detected by a receiver tuned to the frequency of the tag. This activates a tone decoder in the receiver, which is monitored by the DCC for a maximum of four seconds, returning the period for a pulse if one occurred. This is done five times, and the average and variance calculated. If the temperature is in the range of 1.0 to 25.5 degrees centigrade and the variance is less than 5000 (as units of 100th of a degree), valid data is assumed. The frequency, temperature, date, time and variance of valid data are stored in the DCC memory as a block of 9 bytes. Approximately 25,000 data points can be stored before data overflow occurs, at which time, data will be overwritten starting with the oldest data. Receiver radio frequency gain must be set by the operator. Proper adjustment of the gain control is essential to reduce background noise to an acceptable level without sacrificing distance/depth reception. Power to the receiver is supplied by a 12 V deep cycle (RV type) battery (Figure 4).

In order to determine range reception capabilities at each listening station, an operating radio tag was suspended horizontally at the 1 m depth beneath a vessel which progressively moved offshore along the axis of the antenna. A remote terminal, attached to the DCC, monitored signal reception and subsequent data storage or rejection. Latitude and longitude of the tag were recorded from a Loran C receiver mounted aboard the survey vessel in conjunction with variance calculated by the DCC. Data recording continued to a point where variance greatly exceeded that which would be accepted to memory (5000 - 100th degree). The same procedure was repeated at the 2 m depth, and at subsequent 1 m intervals, until the limits of data acceptance to memory were obtained. Receiver gain was adjusted for each station during the initial tests at the 1 m depth, and verified at subsequent depths during each calibration exercise. The above procedure was repeated at each listening station.

2.3 Lake Trout

Lake trout were collected in short term gill net sets at the 12 m depth along the Pickering 'B' transect. Holding, anesthetizing and recovery procedures were as described for round whitefish. Radiotags with teflon coated attachment wires were externally attached through the dorsal musculature in the same manner as described for round whitefish (Haynes and Nettles, 1983, Figure 1). Four fish were tagged and released on each of October 6 and October 8, with an additional 2 fish tagged and released on October 27. Details of fish length and weight, clips and lamprey scars as well as radiotag specification are included in Appendix 2. All individuals were released to the west of the Pickering 'B' discharge channel, within the reception zone of the Pickering 'B' discharge listening station as shown in Figure 2. Transmitting frequency of individual fish was added to the scan cycle of the Data Collection Computer at each listening station prior to release of the fish.

In addition to temperature data obtained from individual radiotags, temperature monitors were installed at the 5 m depth, within the reception zone of the Pickering 'A' discharge and Pickering 'B' discharge listening stations (Figures 2 and 5). Probes were deployed to record temperature at 1.5, 3.0 and 4.5 m depth at each location.

Instrument deployment and servicing, data collection and transfer, was provided by the Hydraulic Design Section of Design and Development Division - Generation.

2.4 Smallmouth Bass

Smallmouth bass were collected from the discharge channels by scuba divers equipped with hand held dip nets. In this manner, large bass could be selected, and tag weight effects minimized as tags were initially ordered for 2-3 kg trout. Holding, anesthetizing and tagging procedures were as outlined for lake trout. Three bass were captured, tagged and released in the Pickering 'A' discharge on November 3, 1987, while two bass were tagged in the Pickering 'B' discharge channel November 2

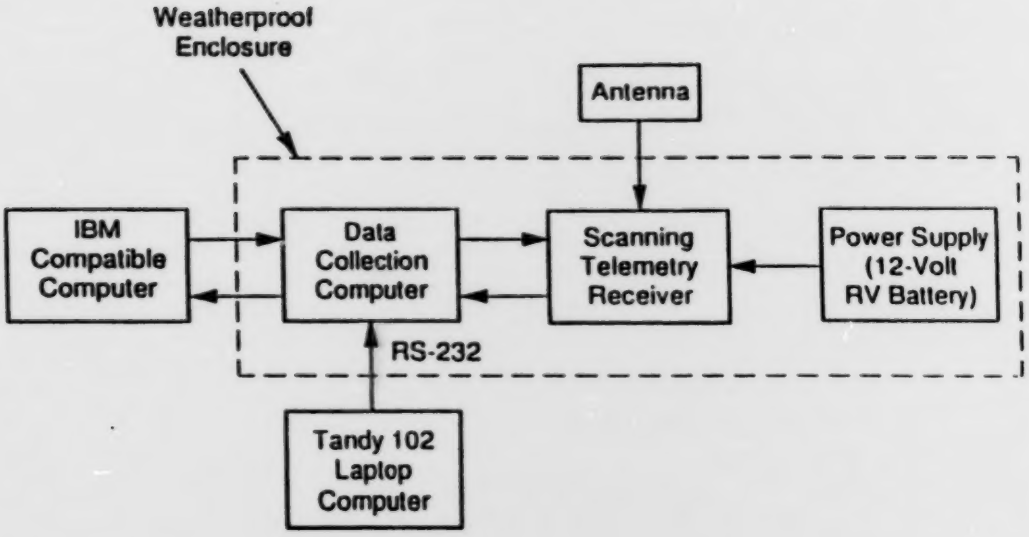

FIGURE 4

**RELATIONSHIP OF OPERATING COMPONENTS
OF AUTOMATED TELEMETRY SYSTEM
PICKERING NGS, 1987**

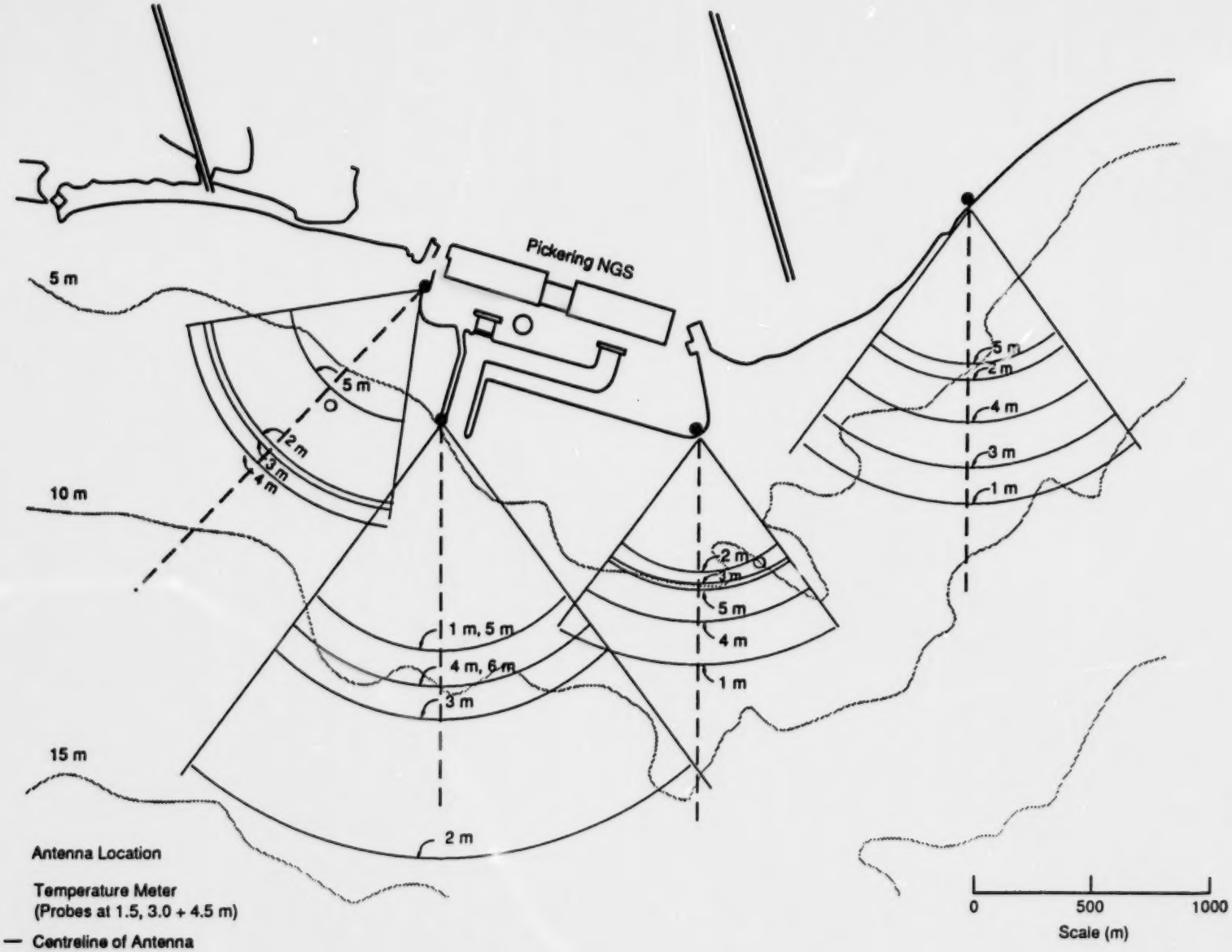

FIGURE 5

MAXIMUM DEPTH/DISTANCE RECEPTION CAPABILITIES OF
LAND-BASED TELEMETRY RECEIVING STATIONS,
PICKERING NGS, 1987

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and November 4, 1987. Fish meristic data and transmitter characteristics are included in Appendix 2 and release points are shown in Figure 2. As with lake trout, tag frequencies were added to the scan cycle prior to fish release. Comparative temperature data for Pickering NGS 'A' and 'B' discharge channels were supplied by the Environmental Protection Department.

3.0 RESULTS & DISCUSSION

3.1 Round Whitefish

The results of round whitefish tracking efforts are presented in Table 1 and shown diagrammatically in Figures 6 and 7. These figures indicate the release point of all round whitefish tagged and their position on subsequent days. Fish bearing transmitters 1 and 8 were not located following their release. All other individuals were located between Thickson Point and the Whitby harbour entrance, with fish bearing transmitter 4 remaining in the local area for the longest period (13 days). All other fish remained in the area for only 1-2 days following their release.

Tracking efforts extended west to Richardson Point and east past Thickson Point on three occasions (November 18 and 27, December 15, 1986) with negative results in each case. In most cases, the outbound survey was conducted along the 3-5 m depth contour, while the return survey was conducted further offshore (approximately 7 m depth contour). On all other tracking days, surveys were limited to more intensive coverage of the area between Thickson Point and Whitby harbour. Surveys could not be continued past December 15, 1986 due to freeze-up of the local harbour (Whitby).

Our inability to locate fish on subsequent days was dependent on a number of factors. First, small transmitters, such as the type that were used have a limited signal output. However, small transmitters had to be used due to restrictions imposed by the carrying capacity of the round whitefish. This in turn limits reception in terms of depth and distance. Tests conducted with a reference transmitter on November 18, 1986, following failed attempts to locate fish bearing transmitters 1,2 and 3, indicated that tags were barely audible at the 10 m depth (range < 20 m), were discernible to about 200 m at the 6 m depth, and to about 370 m at the 3 m depth. These results agree with information published by Weeks et al. (1977), which indicate that range reception could be reduced to 5-10% of transmitter surface range at the 10 m depth. Loss mechanisms affecting reception of a signal from a submerged transmitter were also investigated by Velle et al (1979). Factors which influence the effective reception distance of a submerged transmitter include:

1) frequency of the transmitter;

2) depth of the transmitter;

3) power output of the transmitter;

4) water temperature;

5) conductivity of the water;

6) distance from the point where the transmitted signal emerges from the water surface to the receiving antenna; and

7) height of the receiving antenna above the water surface.

TABLE 1

SUMMARY OF ROUND WHITEFISH TRACKING EFFORTS
NOVEMBER - DECEMBER, 1986

DATE	SURVEY TRANSECT AND DEPTH	TIME	FISH I.D.	DEPTH (M)	LOCATION (LAT/LONG)	WEATHER
NOV 13	WHITBY HARBOUR TO THICKSON PT 3-5 M DEPTH	1200-1230	#4	4.5	43 50 45 78 54 58.5	CLEAR, CALM
			#3	1.5	43 50 46.5 78 54 40	
	THICKSON PT TO WHITBY HARBOUR 6-8 M DEPTH	1400-1430	#4	3	43 50 34.8 78 54 48	
			#3	2	43 50 35 78 54 36	
			#2	10	43 50 20 78 54 24	
NOV 17	WHITBY HARBOUR TO THICKSON PT AND RETURN	1130-1245	#4	9	43 50 46.5 78 55 09	WIND W-SW SEAS 1-1.5 M
NOV 18	WHITBY HARBOUR TO GOLD PT AND RETURN. 2-4 M AND 4-8 M.	1030-1200	#4	6	43 50 48 78 55 14	WIND NE, 10-20 KM/H SEAS 0.5 M
	WHITBY HARBOUR TO THICKSON PT AND RETURN. 2-4 M & 4-8 M.	1330-1530				WIND SE, LIGHT SEAS 0.3-1.0 M
NOV 19	WHITBY HARBOUR TO THICKSON PT AND RETURN. 3-5 M & 7-9 M.	1045-1230				WIND N, LIGHT SEAS <1.0 M
NOV 26	WHITBY HARBOUR TO THICKSON PT AND RETURN. 3-5 M & 7-9 M.	1300-1430	#5	5.5	43 50 52 78 55 21	
			#6	6.4	43 50 34 78 54 48	
			#7	6.1	43 50 35 78 54 46	
			#4	7	43 50 28 78 54 25	
NOV 27	WHITBY HARBOUR TO RICHARDSON PT AND RETURN. 3-5 M & 5-7 M.					CLEAR, CALM
	WHITBY HARBOUR TO GOLD PT AND RETURN. 5-7 & 7-9 M.		#5	8	43 50 36.5 78 55 17	CLEAR, CALM
			#6	8	43 50 35 78 55 28.5	
DEC 9	WHITBY HARBOUR HALF WAY TO THICKSON PT AND RETURN					WIND SE, 50-60 KM/H SEAS 1-1.5 M
DEC 11	WHITBY HARBOUR TO THICKSON PT AND RETURN. 6-8 M DEPTH	0900				WIND SW, <20 KM/H SEAS 0.5 M
DEC 15	WHITBY HARBOUR TO RICHARDSON PT					
	<8.0 M DEPTH					
	WHITBY HARBOUR TO CORBETT CK <8.0 M DEPTH					

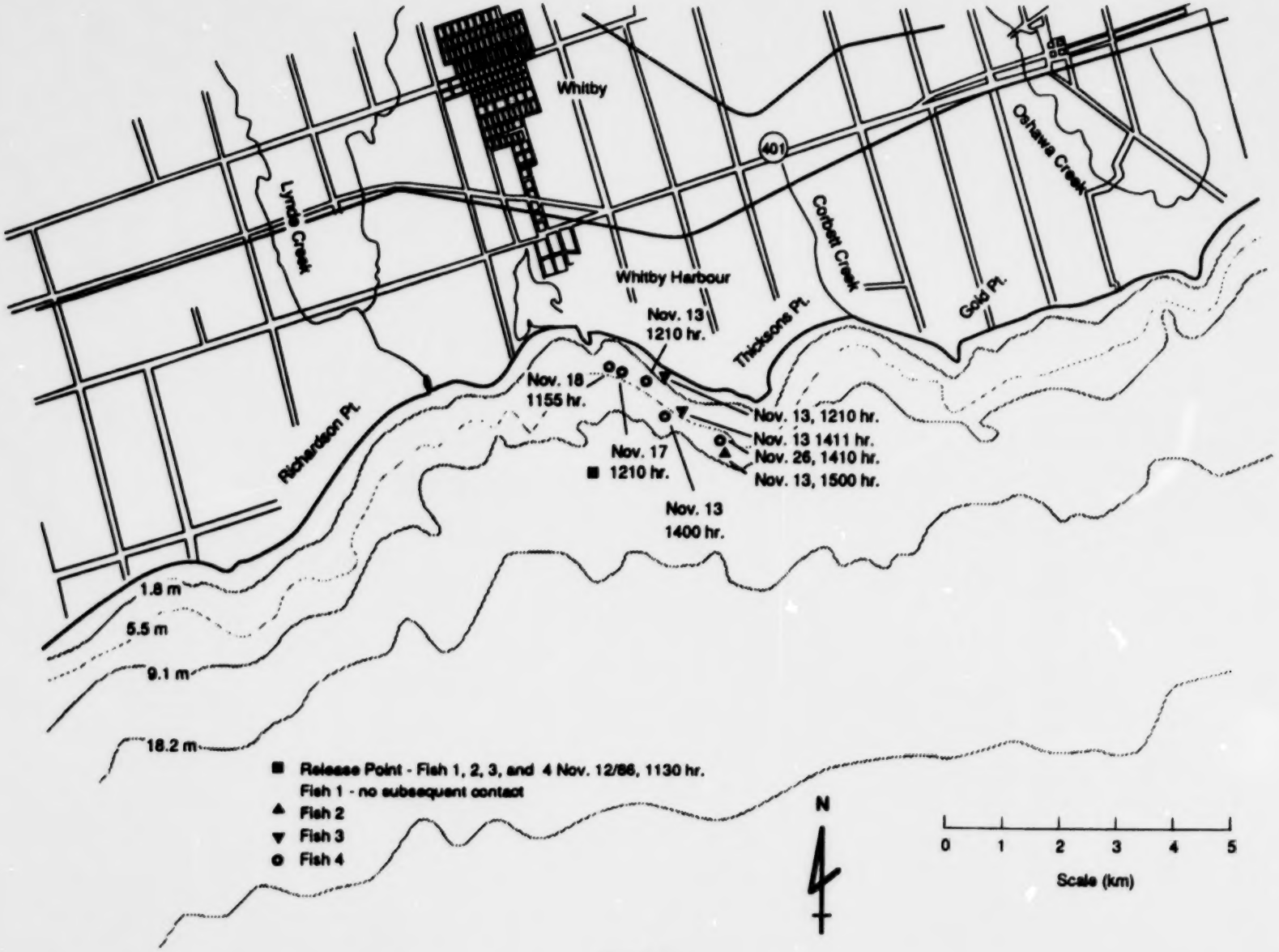


FIGURE 6

RELEASE POINT AND SUBSEQUENT LOCATIONS OF ROUND WHITEFISH 1 - 4 AT WHITBY, FALL, 1986

I:\90021\F11.PD

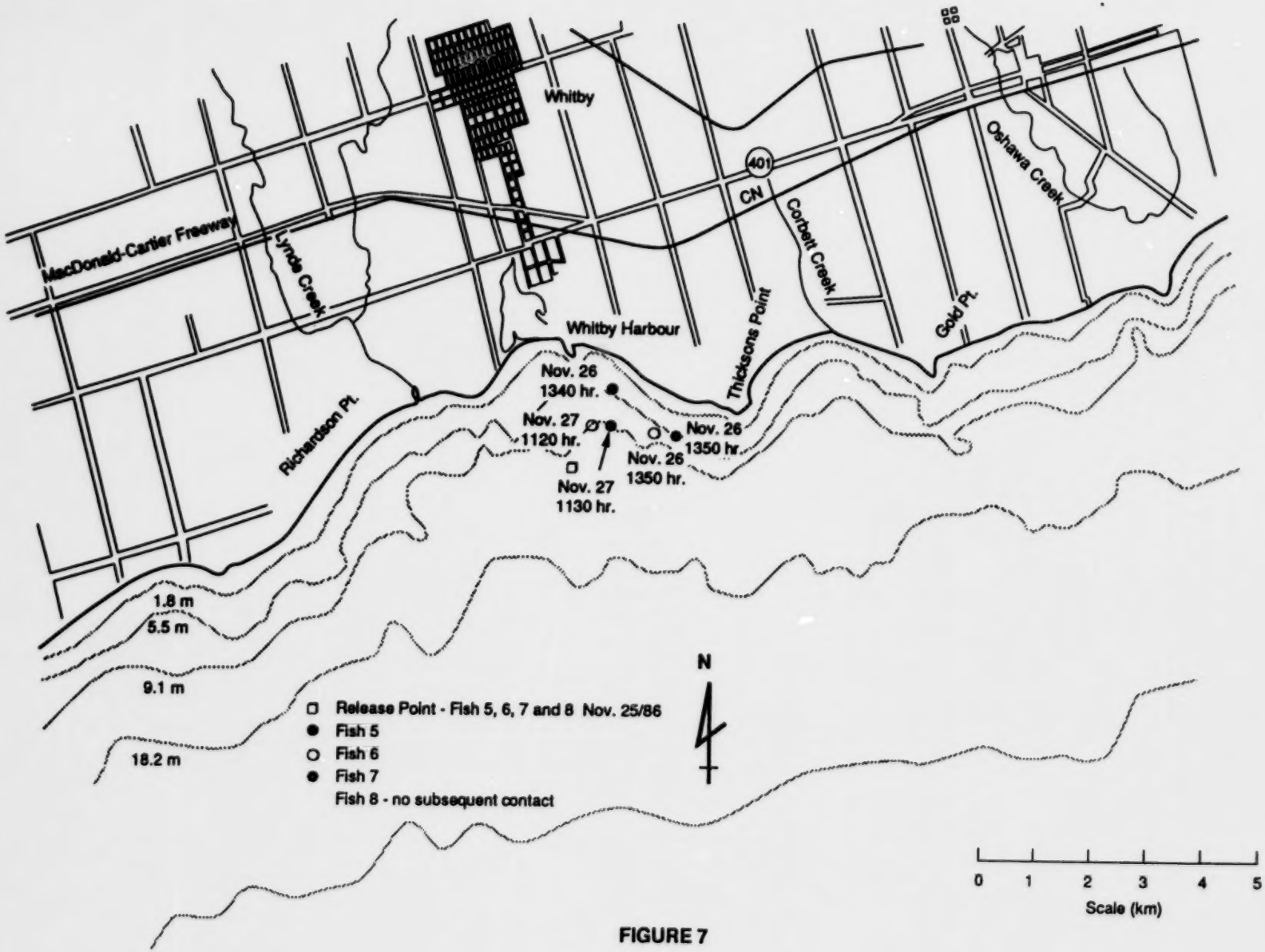


FIGURE 7

RELEASE POINT AND SUBSEQUENT LOCATIONS OF ROUND WHITEFISH 5 - 8 AT WHITBY, FALL, 1986

90-81

180920-F11-RD

The overall effect of the above factors and their influence on the reception capability of the reference transmitters mentioned earlier are shown in Table 2 with example calculations presented in Appendix 3. Total signal loss for all three depths was very similar, ranging from 117 to 123 db (Table 2) indicating that the receiving system was equally effective in each test. Hence, one can establish the operating limits of a receiving system in this manner. Further increases in transmitter power output, or receiving system gain, would act to increase the overall reception capabilities of the tracking system. Thus, under the conditions present in this study, as fish move beyond the 6-7 m depth, their chances of being located decrease dramatically, with little chance of detection at the 10 m depth and beyond.

Weather and lake conditions were generally less than favourable for much of the time that tracking efforts were taking place. This limited the overall time that could be devoted to searching, as well as reducing the effectiveness of searching operations during marginal conditions (seas to 1 m, freezing rain, snow, etc.) due to increased signal interference.

Radiotagging studies of other coregonid species are infrequent in the literature. A series of studies have been conducted on the North American Arctic migratory whitefishes in the Mackenzie delta (Alt, 1975; McCleod et al., 1979; Chang-Kue and Jessop, 1983) but no previous work is reported for round whitefish. Arctic studies were successful in tracking pre-spawning adults to their spawning grounds at a number of locations.

Thus, the precise location of round whitefish spawning areas near Whitby cannot be determined from this study. The last contact with tagged individuals occurred November 27, which is well prior to their customary peak spawning period of mid-late December (OHRD Report No 89-149-K). Aircraft tracking would probably have proved beneficial as tracking could have continued past December 15, into the period when spawning takes place.

3.2 Automated Tracking System Calibration and Operation

The results of calibration tests at each of the four automated listening stations established at Pickering NGS are presented in Table 3 and shown diagrammatically in Figure 5. The distances shown in Table 3 and Figure 5 are the outer range limits at which the signal from a transmitter would be accepted by the Data Collection Computer. Thus, these distances represent the effective operating lakeward range of each listening station under the environmental conditions present at the time of testing.

Examination of these results indicates that considerable variability in range reception occurred between individual listening stations. The greatest distance reception capabilities were obtained at the intake location, which was capable of receiving, and accepting to memory, data from a tag at a distance of 1.45 km and water depth of 2 m. Reception capabilities extended to a minimum of 0.75 km for all other depths tested, up to and including the 6 m depth. At all other listening stations (Pickering A discharge, Pickering B discharge and Pickering East) range reception extended to approximately 500 m at the 5 m depth and increased to 800 to 900 meters at shallower depths. Irregularities observed at the 1 m depth at Pickering A station and 2 m depth at the Pickering B station are considered to be the result of station background noise. Electrical noise (static from machinery, bursts from high voltage switching operations) was most noticeable at the Pickering A listening station, and was also apparent at the Pickering B location. This noise resulted in a reduction in the receiver gain setting (sensitivity) in an effort to eliminate or reduce on line static to a level which did not interfere with DCC signal acceptance criteria. This in turn, resulted in the reduction in effective range reception capabilities for the listening station.

Antenna calibration data supplied by Cedar Creek Bioelectronics Ltd. (Appendix 4) for the Telex Hy-gain Model 64B-S antenna (Model 64B-S, 6 m band) indicated that the reception beam width was ±

TABLE 2

EFFECT OF DEPTH, DISTANCE AND ANTENNA HEIGHT
ON SIGNAL LOSS OF A SUBMERGED REFERENCE TRANSMITTER

	TRIAL NUMBER		
SIGNAL LOSS FACTORS	1	2	3
TRANSMITTER FREQUENCY (MHZ)	50.4	50.4	50.4
TRANSMITTER DEPTH (M)	3	6	10
WATER TEMPERATURE (C)	8	8	8
CONDUCTIVITY OF WATER (uM/m) *	325	325	325
HEIGHT OF ANTENNA (M)	6	6	6
DISTANCE FROM ANTENNA TO EMERGENT SIGNAL (M)	370	200	<20
POLARIZATION	PARALLEL	PARALLEL	PARALLEL
SIGNAL LOSSES (dB)			
WATER	18	36	60
REFRACTION AND SPREADING	-45	-35	-25
PROPAGATION	57.8	52.4	32.4
TOTAL	120.8	123.4	117.4

* ESTIMATED FROM PICKERING 1981 DATA, RANGE 300-350 uM/m.

TABLE 3

RECEPTION RANGE OF AUTOMATED RADIOTELEMETRY RECEIVING STATIONS
PICKERING NGS, 1987

LOCATION	DATE	STATION COORDINATES (LAT/LONG)	TRANSMITTER DEPTH (M)	TRANSMITTER COORDINATES (LAT/LONG)	RECEPTION DISTANCE (M)	LAKE DEPTH (M)
PICKERING A DISCHARGE	SEPT 23	43 48 36.2 79 04 37.3	1		NO VALID DATA	
			2	43 48 20.5 79 04 40.4	690	7.3
			3	43 48 20 79 04 41.3	710	7.6
			4	43 48 18.9 79 04 42.8	860	7.9
			5	43 48 26.3 79 04 32.4	540	5.5
PICKERING INTAKE	SEPT 23	43 48 22.5 79 04 32.7	1	43 48 00 79 04 32.7	770	9.1
			2	43 47 40 79 04 32.7	1450	14.8
			3	43 47 55.5 79 04 32.7	925	10.9
			4	43 47 57.5 79 04 32.7	855	10.0
			5	43 48 00 79 04 32.7	770	9.1
			6	43 47 58 79 04 32.7	840	10.0
PICKERING B DISCHARGE	SEPT 22	43 48 21.7 79 03 36.4	1	43 47 56 79 03 36	880	8.0
			2	43 48 08.5 79 03 36	450	4.8
			3	43 48 05.4 79 03 36	560	5.1
			4	43 48 04.5 79 03 36	590	5.7
			5	43 48 06.5 79 03 36	520	5.0
PICKERING EAST	SEPT 22	43 48 44.7 79 03 00	1	43 48 15.9 79 03 00	984	8.5
			2	43 48 28 79 03 00	570	5.0
			3	43 48 19.5 79 03 00	860	7.5
			4	43 48 23.5 79 03 00	725	6.3
			5	43 48 29.4 79 03 00	520	5.0

35°. This is shown diagrammatically for each listening station in Figure 5. Although not shown in the illustrations, antennae located at both Pickering A discharge and Pickering B discharge had sufficient back-end gain, that signals from transmitters located within the discharge channels, inshore of the listening stations, were accepted to memory. Thus at these two stations, complete coverage of the discharge channel was maintained, as well as the measured distance reception capabilities lakeward.

Output power of individual tags utilized in the subsequent lake trout study are listed in Table 4. All calibration tests in this study were conducted with the tag operating at 50.382 mHz. This transmitter is near the lower end of the range of power output, and would then present a conservative estimate of distance reception at individual stations.

Electrical background noise (static, hum, beeps, etc.) may vary considerably between frequencies employed during radiotelemetry studies (J. Lotimer, Personal Comm.). In this study no attempt was made to compare and/or determine variation in noise levels at the frequencies used, as the automated receiving system did not have the capability to adjust receiver gain between individual frequencies. Recent advances in receiver technology however, have resulted in a receiver which does evaluate background noise levels and automatically adjusts receiver gain (Lotek, 1988). This type of receiver would be particularly valuable when trying to operate in a high noise environment, as was encountered at both the Pickering 'A' and 'B' locations.

TABLE 4

Output Characteristics of Cedar Creek Radiotags

PEAK R.F. POWER OUT - 1 Lm (MAX)*

TAG FREQUENCY (mHz)	DC OUTPUT (mA)
50.255	0.17 - 0.18
50.289	0.17 - 0.18
50.299	0.14 - 0.15
50.324	0.13 - 0.14
50.343	0.15 - 0.16
50.365	0.17 - 0.18
50.382	0.13 - 0.14
50.404	0.13 - 0.14
50.430	0.12 - 0.13
50.494	0.14 - 0.15

* (Measured with antenna just under surface of the water which yields peak radiated power).

A number of operational problems (Appendix 5) were encountered during subsequent tracking studies aimed at determining distribution of lake trout and smallmouth bass in the vicinity of the stations. These problems were of two major types:

1) Failure of antennae components due to metal fatigue of antennae elements in high energy (windy) environments (ie., intake location and Pickering B discharge location); and

2) Failure of data collection computer to maintain control of receiver scan cycle and to provide retrieval of stored data. On a number of occasions, the DCC would "lock up", resulting in lost scanning capabilities. At the same time, this condition also resulted in data loss, as complete power down was required to escape from the "lock up" conditions. On some occasions, rebooting of the unit (power up) resulted in a resumption of normal operational capabilities. Examination of DCC's by the manufacturer, after all units were removed from field installations, revealed no hardware or software malfunctions. It was assumed that moisture within the DCC was the main cause of the problem. These units were operating in an environment of high humidity, with frequent diurnal fluctuation through the freezing point, which would result in condensation formation within the unit. DCC's were subsequently enclosed in water tight containers, with sealed communication ports and a quantity of desiccant (moisture absorbing material). Testing of two of these units at Pickering GS between September 1988 and January 1989 indicated normal operation.

An example of data output from the DCC is shown in Table 5. Software provided by Cedar Creek Bioelectronics Ltd. (PROCOMM) allowed data to be downloaded from the DCC, via an RS-232 communication port to an IBM compatible PC. A program was developed to sort individual transmitter frequencies from the main data file and output these groups to separate data files (Appendix 6). These files were then used to compute residence times for individual fish at particular listening stations.

3.3 Lake Trout

Results of automated radiotelemetry tracking operations for ten individual lake trout are presented in Table 6. Results for individual tracking stations are presented by location in Appendix 7. Unfortunately, almost complete data loss occurred at Pickering A, Pickering Intake and Pickering East due to data collection computer malfunction either during the tracking program or after removal from service. Data listed in Appendix 7 from these locations was transcribed from the data listings present during routine servicing and battery replacement. Temperature data obtained from instruments deployed within the reception range of the Pickering 'A' and Pickering 'B' receiving station from September 19 to December 17 and September 29 to December 23, respectively, are presented in Figures 8 and 9 and Table 7.

Of the ten lake trout tagged, only two fish, those bearing transmitters 50.255 and 50.289, remained within the study area following tagging. The lake trout labelled with transmitter 50.289, however, was located on the beach near the Pickering East listening station eight days after tagging. The other lake trout (50.255) left the study area on October 6, 1987, but returned again on two separate occasions (October 21 and 30-31, 1987). On the first occasion (October 21, 1987) the trout arrived at the generating station from the west, passing the Pickering 'A' station at 04:39 hrs, and the Pickering 'B' station at 06:23 hrs of the same day. Temperature range recorded for this fish during the encounter at Pickering A discharge was 11.6-13.4°C (Table 6). Comparable temperatures (Table 7) were present between the 3.0 and 4.5 m depth (10.7-13.1°C) at the Pickering A temperature monitor during the same time period (04:00-06:00 hrs). Effluent temperature for this period was not available due to station unit computer software problems. Data collected from this fish as it passed the intake was lost due to DCC failure. No contact was established at the Pickering East location.

On the second occasion (October 30-31, 1987) the lake trout again arrived at Pickering NGS from the west, coming into contact with the Pickering 'A' listening station at 20:07 hrs on October 30, 1987. It remained within the reception zone of this station for 10 minutes, left and returned again at 18:26 hrs on October 31. Upon passing out of the reception zone of this listening station, the trout passed the Pickering B station at 19:12 and the Pickering East station at 19:49 hrs. The intake station was disabled during this time. Water temperatures recorded for the trout ranged from 13.6 - 14.0°C on

TABLE 5

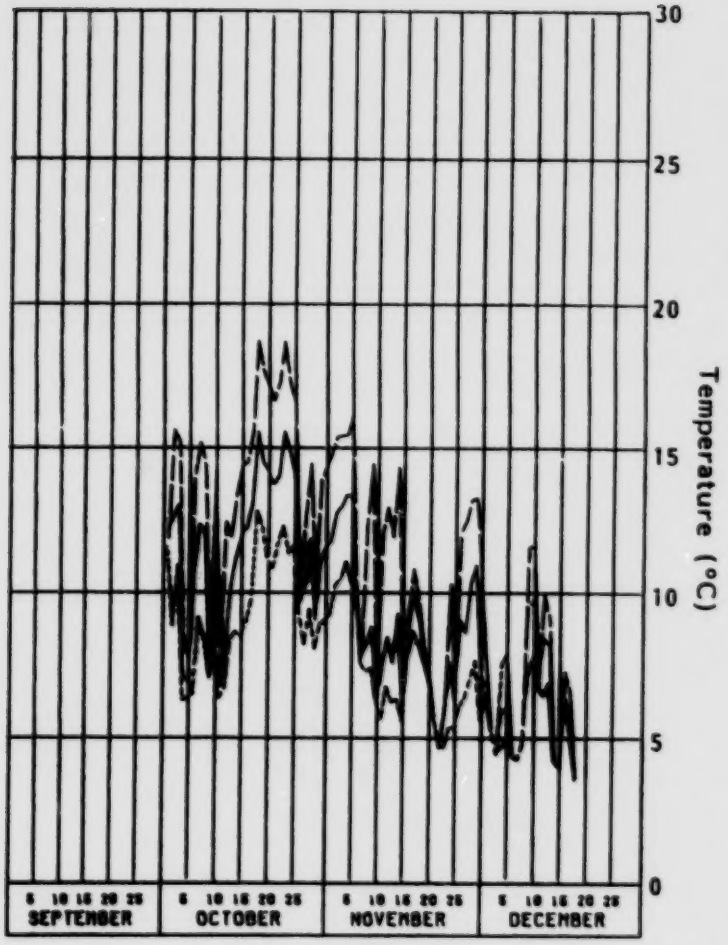
SAMPLE DATA OUTPUT FROM CEDAR CREEK
DATA COLLECTION COMPUTER

JULIAN DAY	TIME	TRAN. FREQ.	TEMP. (XX.X)	VARIANCE
280/	4:17	1287	109	23
280/	4:17	1289	109	73
280/	4:25	1287	111	4
280/	4:25	1289	111	3
280/	4:33	1287	109	29
280/	4:41	1287	108	6
280/	4:49	1289	107	6
280/	4:50	1287	107	159
280/	4:58	1289	108	22
280/	4:58	1287	108	194
280/	5:06	1289	107	13
280/	5:06	1287	107	71
280/	5:14	1289	107	104
280/	5:14	1287	107	9
280/	5:22	1287	107	14
280/	5:22	1287	109	15
280/	5:30	1287	109	14
280/	5:31	1287	109	30
280/	5:39	1287	109	276

TABLE 6

RECORD OF LAKE TROUT CONTACTS
PICKERING TELEMETRY RECEIVING STATIONS

RADIOTAG FREQUENCY	LOCATION	DATE	TIME	CONTACT DURATION (HRS)	TEMPERATURE RANGE
50.255	B DIS	OCT 6/87	13:25	0.1	13.7
	INTAKE	OCT 6/87	13:49	0.3	6.5-13.9
	A DIS	OCT 6/87	13:59	0.1	7.3
	INTAKE	OCT 6/87	14:05	4.9	6.4-8.7
	A DIS	OCT 21/87	04:39	0.7	11.6-13.4
	B DIS	OCT 21/87	06:23	0.1	11.4
	A DIS	OCT 30/87	20:07	0.2	13.6-14.0
	A DIS	OCT 31/87	18:26	0.1	12.0
	B DIS	OCT 31/87	19:12	0.2	12.9-14.7
	EAST	OCT 31/87	19:49	0.2	9.5
50.289	B DIS	OCT 6/87	13:32	10.5	
		OCT 7/87		24.0	
		OCT 8/87		24.0	
		OCT 9/87		18.0	
	EAST	OCT 9/87	18:24	PRESENT	
		OCT 10/87	17:43	PRESENT	
		OCT 11/87	08:28	PRESENT	
		OCT 12/87	04:14	PRESENT	
		OCT 13/87	11:24	PRESENT	
		OCT 14/87	15:30	RECOVERED FROM BEACH BELOW STATION	
50.299	B DIS	OCT 6/87	13:27	0.3	15.0-6.3
		NO FURTHER CONTACTS			
50.324	B DIS	OCT 6/87	13:51	0.1	13.7
		NO FURTHER CONTACTS			
50.343	B DIS	OCT 8/87	14:15	0.1	9.2
		NO FURTHER CONTACTS			
50.365	B DIS	OCT 8/87	14:17	0.1	8.7
		NO FURTHER CONTACTS			
50.382	B DIS	OCT 8/87	14:17	0.1	8.3
		NO FURTHER CONTACTS			
50.404	B DIS	OCT 8/87	14:50	0.1	9.2
		NO FURTHER CONTACTS, 1987			
50.430	B DIS	OCT 27/87	11:15		
		CAPTURED JUNE 25/88 NEAR OAK ORCHARD, NEW YORK AT 18 M. DEPTH IN 40 M. OF WATER. APPEARED HEALTHY, SUBSEQUENTLY RELEASED BY ANGLER			
50.494	B DIS	OCT 27/87	11:15	0.7	12.8-8.6
		CAPTURED BY ANGLER - SUMMER, 1988 NORTH SHORE, L. ONTARIO			



— — 1.5 m
——— 3.0 m
—— 4.5 m

FIGURE 8

MEAN DAILY WATER TEMPERATURE AT
PICKERING 'A' DISCHARGE MONITORING STATION
FALL, 1987

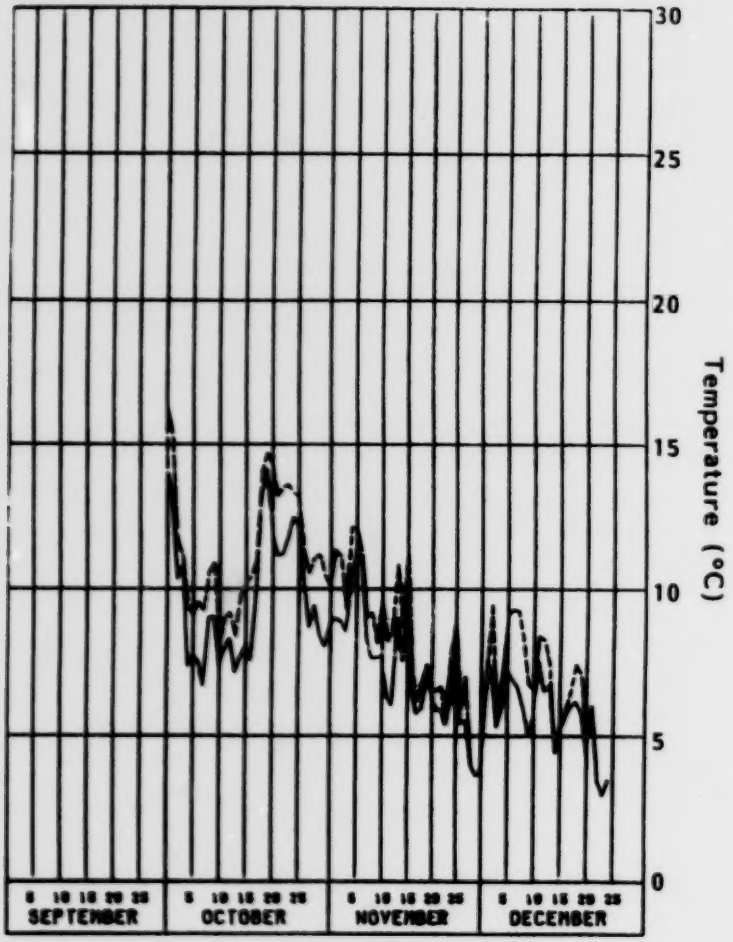


FIGURE 9

MEAN DAILY WATER TEMPERATURE AT
PICKERING 'B' DISCHARGE MONITORING STATION
FALL, 1987

TABLE 7

HOURLY TEMPERATURES AT PICKERING "A" AND "B" MONITORING STATIONS AND DISCHARGE CHANNELS

DATE	TIME	PICKERING A DISCHARGE				PICKERING B DISCHARGE			
		1.5 M	3.0 M	4.5 M	EFFLUENT	1.5 M	3.0 M	4.5 M	EFFLUENT
OCT 21	0400	17.9	12.9	10.8	NR				
	0500	17.8	12.9	10.7	NR				
	0600	17.3	13.1	10.7	NR	NR	13.0	10.9	18.5
	0700					NR	13.0	11.0	18.5
OCT 30	1900	15.3	13.3	10.0	NR				
	2000	14.7	13.3	10.7	NR				
	2100	14.4	13.3	11.1	NR				
OCT 31	1800	15.7	11.7	10.8	NR				
	1900	16.3	11.7	10.5	NR	NR	11.9	8.8	21.1
	2000					NR	12.2	9.0	20.9

NR - NOT RECORDED, INSTRUMENT FAILURE

October 30, to 12°C for the single contact on October 31 at the Pickering 'A' station. Corresponding temperatures were present between 1.5 and 3.0 m depth at the remote temperature monitor on both October 30 and 31. Effluent temperature for these periods was again unavailable. The temperature range recorded at Pickering B discharge for this trout was 12.9 - 14.7°C, again corresponding to water above the 3 m depth. Water temperatures were not recorded at 1.5 m depth due to instrument breakdown at the Pickering 'B' remote temperature monitor. Effluent temperature at this time was 20.9 - 21.1°C (OHEPD). Temperatures experienced by the trout during two contacts with the Pickering East listening station (19:49 and 20:00 hrs) were 9.5 - 9.6°C.

No further contacts were established with six of the eight remaining tagged lake trout to the end of the program in 1987 or during equipment tests from September 1988 to January 1989 (Frequencies 50.299, 50.324, 50.343, 50.365, 50.382). Two (50.430 and 50.494) fish were captured by anglers during the summer of 1988 (Table 6), with one (50.430) released following examination.

Although lake trout may be attracted to the thermal discharge of a generating station, it appears that their residency period within the heated effluent is sporadic and short. On both occasions that a radiotagged lake trout was present in the study area, the period of residency was less than one hour. During this time, the temperature range experienced by the fish was always a number of degrees below the actual effluent temperature, indicating a preference for the offshore mixing area of the thermal plume. Maximum duration of residency within the range of the receiving stations was approximately 24 hours. During residency surveys of the discharge channels, only 3 lake trout were observed in the spring of 1987 and 1 in the spring of 1988 in the Pickering 'B' discharge channel, while none were observed in the Pickering 'A' discharge channel (OHRD Report No 88-267-K, in draft). Concurrent gill netting in the offshore portion of the thermal plume (March-April) indicated that lake trout were present in considerable numbers (CUE 2.2-8.4) at this time of year. Results of commissioning and post-operational netting surveys (1984-1988) at Pickering NGS (OHRD Report Nos 87-149-K, 87-194-K, 88-261-K, 89-149-K), indicate that lake trout numbers are highly variable, both seasonally and annually (Table 8). Catches ranged from zero in August of 1984 and 1987, to more than 10 trout/net set during August, October and November 1986 and October 1987. Haynes and associates (Haynes, 1983; Haynes and Nettles, 1983; Haynes and Keleher, 1986; Nettles et al., 1987, Haynes et al., 1988) conducted radiotelemetry and vertical gill netting studies along the south shore of Lake Ontario to determine seasonal distribution of a number of salmonid species (lake trout, brown trout, rainbow trout, coho and chinook salmon). They found that lake trout preferred temperatures of 6-13°C, which were found within and below the thermocline during the summer months, and also exhibit a stronger preference for the bottom (within 3 metres) than brown trout. He noted that most lake trout were found in water less than 30 metres in depth, indicating a preference for nearshore regions.

Lake trout do not appear to remain within one local area for extended time periods as evidenced by the fact that 8 of 10 trout left the study area immediately. This is supported by the results of Floy tagging studies conducted at Pickering NGS between 1986 and 1988 (OHRD 89-149-K). Of over 900 lake trout tagged at Pickering in 1986 and 1987, only 6 of 41 tag returns (as of March, 1989) were from the Pickering area. Two lake trout tagged by Haynes (1983) along the south shore at Lake Ontario during spring and fall of 1981, both disappeared into nearby deep water, never to be heard from again.

Lake trout also appear to be capable of long range travel, as indicated by the individual (50.430 from Pickering) captured and released near Oak Orchard, New York. Floy tagging results also show a wide distribution of tag returns, with approximately one quarter (10 of 41) received from the south shore of Lake Ontario.

TABLE 8

LL Lake Trout Numbers and Catch Per Net Set at Pickering NGS, 1984-1988

Year		May	Jun	Jul	Aug	Sept	Oct	Nov
1984	#	86		0				70
	CUE	5.4		0				4.4
1985	#	58		78				24
	CUE	3.6		4.9				1.5
1986	#	100	46	10	177	96	177	216
	CUE	6.3	2.9	0.6	11.1	6.0	11.1	13.5
1987	#	70	17	24	0	4	239	119
	CUE	4.4	1.0	1.5	0	0.3	14.9	7.4
1988	#	39	10	38	9	70	37	133
	CUE	2.6	0.6	2.4	0.6	5.0	2.3	8.3

Thus it appears that lake trout range widely throughout Lake Ontario, and come into contact with Pickering's thermal discharges in the normal course of their travels. They do not appear to exhibit any long term attraction to the elevated temperatures of the discharge, but may remain in the outer mixing zone, within their area of thermal preference, for short periods. The large net catches obtained during post-operational studies probably reflect the overall increase in usage of the inshore area by an expanding lake trout population, rather than a strong attraction to the thermal discharge. It appears unlikely that the periods of plume residency observed during this study would affect sexual maturation of prespawn adults.

3.4 Smallmouth Bass

Results of smallmouth bass tracking are presented in Table 9 and Appendix 7. Data from bass tagged in the Pickering 'A' discharge is limited to that transcribed from data collection computers during routine servicing as the remainder of the data file was lost due to data collection computer failure. Maximum and minimum daily discharge temperatures are also included in Table 9.

Of the 5 bass tagged in the two discharge channels, no interchange occurred between Pickering 'A' and Pickering 'B' (approximately 3 months). Bass remained within their respective habitats until equipment failure in mid-December.

As previously noted, all data from the Pickering A receiving station, with the exception of that transcribed during routine servicing, was lost due to data collection computer failure. However, a large number of contacts (>16,000 contacts, Appendix 7) were established between the three bass tagged at Pickering 'A' and the Pickering 'A' receiving station by January 7, 1988. Of these tagged bass, it appears that the two bearing transmitters 50.331 and 50.353 left the discharge by mid November, resulting in a residency period of less than two weeks following their initial capture. The remaining bass (50.370) left the area some time near January 7, 1988 resulting in a residency period of approximately two months. No subsequent contacts were recorded during continued operation of the receiving system in the month following this date. Discharge temperatures are not available for this period due to station computer software problems.

At Pickering 'B', both tagged bass (50.274 and 50.414) remained in the vicinity of the discharge from initial tagging until December 10, 1987. Both exhibited surprisingly similar patterns of discharge use, initially alternating between 3-4 days presence, followed by 1-2 days absence. The bass bearing tag

50.274 however was present in the discharge for considerably longer intervals than the bass bearing tag 50.414. As time progressed, duration of the periods of absence from the discharge increased, with both fish being absent from the discharge for approximately two weeks prior to the final contact on December 10. The final contact for 50.274 was received at the Pickering East station, indicating departure in that direction. Previously, this bass was detected at the eastern station on November 24 and November 28, but due to computer failure, complete records are not available. It is however considered that the 190 contacts (Appendix 7) received between November 24 and 28 at the Pickering East station were all from this fish (50.274) indicating a four day period of residency near this station. Bass 50.414 was also detected briefly at this station on November 6, 7 and 8. Bass normally prefer moderately shallow waters (Scott and Crossman, 1973) and hence it is not unexpected that they leave the discharge area by an alongshore course rather than an offshore one.

Comparison of discharge temperature range and radiotag temperature range, indicate that bass utilize the higher temperature inner portion of the discharge channel rather than the offshore mixing area which was preferred by lake trout. In all but one case (December 10, 50.274) temperatures experienced by bass were within a few degrees (2-3°C) of the temperature range measured in the discharge. Similar results were recorded by Wyman (1981). He found that bass prefer areas of the discharge where temperatures were within a few degrees of maximum and they spent longer periods of time in these areas than in those of maximum discharge temperature.

Thus, it appears that smallmouth bass are periodic residents of the thermal discharge rather than full time residents. Floy tagging studies conducted on the Pickering 'A' and 'B' discharge during the spring of 1987 (OHRD 88-267-K) also indicated that bass are not full time residents of the discharge. Of 50 smallmouth bass tagged in both discharge channels, 7 or less were observed on any subsequent date. There is evidence of homing to spawning grounds and summer territory, (Scott and Crossman, 1973), and this is undoubtedly the case with the bass that utilize the Pickering 'B' discharge channel as a spawning and fry rearing habitat. Bass may also utilize the discharge as a foraging zone, and have been found to congregate in the outer eastern margin of the Pickering 'B' discharge during pre-spawning periods (OHRD 88-267-K). Munther (1970) also found that bass were attracted to shear zones at the edge of fluctuating currents.

Day/night activity of smallmouth bass was found to be very similar during radiotagging studies conducted at Pickering A in 1976 (Wyman, 1981), with bass remaining almost as active during periods of darkness (night), as during the day. Previous studies (Munther, 1970; Emery, 1973) had indicated that bass exhibit little movement at night, often settling to the bottom to rest under the cover of twigs or rocks within approximately one hour after full darkness. Daily activity levels were often the highest, however, during the hour preceding full darkness. Day/night activity of smallmouth bass during this radiotelemetry study was determined by noting the time of day that bass moved into or out of the reception area of individual listening stations at Pickering A, B and East. No measure of activity is available for bass when they were resident within or outside the reception zone of the listening stations, but only while in transit between the two areas. No comments can be made on activity levels of Pickering A bass due to the limited number of observations available.

The dates and times that the two bass (50.274, 50.414) entered or exited the reception zones of the Pickering B and Pickering East listening stations during day and night are presented in Table 10. The bass bearing tag 50.274 exhibited more movement in and out of the Pickering B reception zone during day than night, but it is interesting to note that most of the evening movement was of bass leaving the reception zone (discharge area), rather than entering it. All presence/absence status changes of this bass at the Pickering East station took place during daylight hours. The second bass (50.414) also showed more in-out movement during daylight hours than during the evening, but did not exhibit the same trend toward movement out of the discharge at night.

TABLE 9

RECORD OF SMALLMOUTH BASS CONTACTS
PICKERING TELEMETRY RECEIVING STATIONS
PICKERING NGS, 1987

RADIOTAG FREQUENCY	DATE	LOCATION	HOURS PRESENT	HOURS ABSENT	RADIOTAG TEMPERATURE MIN.	RADIOTAG TEMPERATURE MAX.	DISCHARGE TEMPERATURE MIN.	DISCHARGE TEMPERATURE MAX.
50.274	NOV 2	B DIS	10	0	20.8	21.5	20.8	22.9
	3	B DIS	24	0	20.3	22.7	20.6	22.9
	4	B DIS	24	0	20.3	24.0	21.5	24.5
	5	B DIS	17	7	21.8	23.5	21.2	23.7
	6	B DIS	0	24			19.1	21.1
	7	B DIS	4	20	18.2	19.5	17.8	20.5
	8	B DIS	19	5	17.3	21.5	17.9	21.3
	9	B DIS	5	19	18.5	19.7	17.7	19.7
	10	B DIS	0	24			16.8	18.1
	11	B DIS	1	23	18.3		17.6	19.6
	12	B DIS	10	14	14.5	19.1	13.4	19.5
	13	B DIS	18	6	13.3	19.0	13.0	17.6
	14	B DIS	20	4	14.7	17.8	13.4	16.0
	15	B DIS	14	10	18.1	21.4	14.6	20.9
	16	B DIS	24	0	18.9	21.3	19.2	21.9
	17	B DIS	24	0	16.8	21.0	18.9	20.4
	18	B DIS	19	5	15.6	20.9	20.4	21.9
	19	B DIS	13	11	17.2	20.1	18.5	20.8
	20	B DIS	0	24			18.8	20.8
	21	B DIS	0	24			18.0	18.9
	22	B DIS	0	24			16.5	19.3
	23	B DIS	14	10	15.9	18.6	17.1	20.5
	24	B DIS	8	16	15.6	21.4	17.3	21.4
		EAST	4		13.6	14.7		
	25	B DIS	0	24			16.7	22.1
	26	B DIS	0	24			17.0	19.0
	27	B DIS	0	24			17.2	20.5
	28	B DIS	0	24			16.7	22.1
		EAST	0.1		3.8	3.8		
	29	B DIS	0	24			15.3	20.4
	30	B DIS	0	24			15.1	20.0
	DEC 1	B DIS	0	24			15.3	19.4
	2	B DIS	0	24			17.3	20.9
	3	B DIS	0	24			16.6	18.8
	4	B DIS	0	24			16.5	19.0
	5	B DIS	0	24			18.0	19.4
	6	B DIS	0	24			18.1	19.0
	7	B DIS	0	24			18.0	19.3
	8	B DIS	0	24			18.8	20.0
	9	B DIS	0	24			18.2	24.4
	10	B DIS	0.3	23.7	9.2	12.3	19.0	24.2
		EAST	0.3	23.7	11.9	15.5		
50.414	NOV 4	B DIS	11		21.3	23.9	21.5	24.5
	5	B DIS	17	7	21.8	23.5	21.2	23.7
	6	EAST	0.1	23.9	18.2	18.2	19.1	21.1
	7	EAST	0.1	23.9	19.3	19.3	17.8	20.5
		B DIS	3	21	19.1	19.5		
	8	B DIS	0.1		17.9	17.9	17.9	21.3
		EAST	0.1	23.9	13.5	13.5		
		B DIS	16	7.9	19	21.5		
	9	B DIS	6	18	19.3	19.8	17.7	19.7
	10	B DIS	0	24			16.8	18.1
	11	B DIS	0	24			17.6	19.6
	12	B DIS	8	16	15.1	18.8	13.4	19.5
	13	B DIS	15	9	15	19	13.0	17.6
	14	B DIS	17.5	6.5	15.9	18	13.4	16.0
	15	B DIS	0.5	23.5	20.5	21.1	14.6	20.9
	16	B DIS	4	20	19.9	20.4	19.2	21.9

TABLE 9 (CONT.)

RADIOTAG FREQUENCY	DATE	LOCATION	HOURS PRESENT	HOURS ABSENT	RADIOTAG MIN.	TEMPERATURE MAX.	DISCHARGE MIN.	TEMPERATURE MAX.
	17	B DIS	1.5	22.5	19.5	21	18.9	20.4
	18	B DIS	0.2	23.8	19.5	20.3	20.4	21.9
	19	B DIS	0	24			18.5	20.8
	20	B DIS	0	24			18.8	20.8
	21	B DIS	0	24			18	18.9
	22	B DIS	0	24			16.5	19.3
	23	B DIS	0	24			17.1	20.5
	24	B DIS	0.2	23.8	19.4	21.1	17.3	21.4
	25	B DIS	0	24			16.7	22.1
	26	B DIS	0	24			17	19
	27	B DIS	0	24			17.2	20.5
	28	B DIS	0	24			16.7	22.1
	29	B DIS	0	24			15.3	20.4
	30	B DIS	0	24			15.1	20
	DEC 1	B DIS	0	24			15.3	19.4
	2	B DIS	0	24			17.3	20.9
	3	B DIS	0	24			16.6	18.8
	4	B DIS	0	24			16.5	19
	5	B DIS	0	24			18	19.4
	6	B DIS	0	24			18.1	19
	7	B DIS	0	24			18	19.3
	8	B DIS	0	24			18.8	20
	9	B DIS	0.4	23.6	19.7	21.6	18.2	24.4
	10	B DIS	0.1	23.9	19.7	19.7	19	24.2
50.331	NOV 9	A DIS *	0.1					
	10	A DIS *	0.1		15.9	15.9		
	12	A DIS *	0.1		17.1	17.1		
	15	A DIS *	0.1		13.1	13.1		
50.353	NOV 9	A DIS *	0.1					
	11	A DIS *	0.1		17	17		
	13	A DIS *	0.1		14.5	17.2		
50.370	NOV 10	A DIS *	0.1		16.5	16.5		
	11	A DIS *	0.1		17.3	17.3		
	12	A DIS *	0.1		17.5	17.5		
	13	A DIS *	0.1		12.4	12.4		
	15	A DIS *	0.1					
	16	A DIS *	0.1		13.8	13.8		
	17	A DIS *	4.5		12.4	12.9		
	25	A DIS *	0.5		17.2	17.7		
	DEC 6	A DIS *	0.2		13.8	16.8		
	7	A DIS *	0.2		17.3	17.3		

* INCOMPLETE DATA, THESE PORTIONS TRANSCRIBED FROM DATA FILES TO FIELD BOOK DURING ROUTINE SERVICING AND BATTERY REPLACEMENT

NA - NOT AVAILABLE

Thus, it appears that this study would support the results of Wyman (1981), that bass remain active at night; but this activity may well be a function of light levels present in the study area rather than an observed change in behaviour. Indeed, Wyman noted that bass leaving the discharge area at night would proceed to lighted areas along the shoreline where they would remain for 30 to 120 minute periods prior to moving to another lighted area. Shoreline lighting is present at both discharge locations and may have had a substantial effect on evening bass movement during this study as well. No evening movement was observed at the Pickering East location, which was not subjected to artificial lighting. This supports Munther and Emery's findings.

Thus, it appears that no definitive statement on bass diurnal activity can be made from the results of this study. Light levels present in the vicinity of the discharge channels at night may be sufficiently close to those experienced by natural populations during the hour preceeding full darkness, that activity levels are increased accordingly. This could account for the observed evening activity.

4.0 SUMMARY

1. Eight round whitefish were radiotagged at Whitby during the fall of 1986 in an attempt to track them to their spawning grounds. One individual remained within the study area for 13 days, but could not be located after November 26, 1986. All other individuals were present for less than two days from the date of tagging, with final contacts on November 27. Tracking efforts were hampered by unfavourable weather conditions during the latter portion of the study period, and freeze-up of the local harbour (Whitby) resulted in cancellation of the program earlier than anticipated. The existence of suspected spawning grounds near Whitby could not be confirmed.

2. An automated radiotelemetry receiving system was installed at Pickering NGS in the Fall of 1987 in an effort to determine the extent of thermal plume residency by pre-spawning salmonids. Listening stations were established at each of Pickering 'A' discharge, Pickering intake, Pickering 'B' discharge and Pickering east boundary. Units installed at each location were independent from one another, thereby avoiding problems associated with hard-wired systems (on-line interference, cable installation, protection and maintenance, cable cost).

   Calibration experiments indicated that a minimum reception range of 500 metres distance and 5 metres depth was attainable at all four receiving stations. Greater distances (maximum 1.45 km at 2.0 metres depth) were obtained at those locations furthest from the powerhouse of Pickering NGS.

   A number of operational problems were encountered during fall/winter 1987 which resulted in the loss of data from 3 of the 4 listening stations. The data collection units appeared to be susceptible to moisture, resulting in internal bridging of circuitry and corresponding loss of communication capabilities with the remote terminal and the telemetry receiver. This resulted in either the loss of real-time data or previously collected data. Modifications to Data Collection Computer housings (waterproofing and addition of moisture absorbing materials) resulted in normal operation during field testing in the fall of 1988. In addition, antennae supplied with the system proved to be too fragile for the higher energy (windy) locations, resulting in impairment of reception capabilities when elements broke off or twisted out of alignment.

TABLE 10

DAY/NIGHT ACTIVITY OF SMALLMOUTH BASS
AT PICKERING B NGS

RADIOTAG FREQUENCY	LOCATION	DIURNAL PERIOD	MOVEMENT INTO RECEPTION AREA	MOVEMENT OUT OF RECEPTION AREA	SINGLE CONTACT
50.274	PICKERING B DISCHARGE	DAY	NOV. 7-11:57 NOV. 9-09:22 NOV.12-12:02 NOV.13-06:16 NOV.15-10:09 NOV.19-10:19 NOV.23-09:42	NOV. 5-16:58 NOV. 7-15:48 NOV. 9-13:47 NOV.24-08:27	NOV.11-13:34
		NIGHT	NOV. 8-05:17 DEC.10-05:41	NOV. 9-04:21 NOV.12-22:02 NOV.18-18:45 NOV.19-23:23 DEC.10-05:57	
	PICKERING EAST	DAY	NOV.24-09:13 DEC.10-10:14	NOV.24-13:23 DEC.10-10:30	
50.414	PICKERING B DISCHARGE	DAY	NOV. 4-15:40 NOV. 7-12:32 NOV. 8-06:54 NOV. 9-11:00 NOV.12-13:23 NOV.13-08:40 NOV.15-12:33	NOV. 5-16:46 NOV. 7-15:21 NOV. 9-14:12 NOV.15-14:22 NOV.17-11:06	NOV.17-18:33 NOV.18-07:07 NOV.24-09:03 NOV.24-13:52 DEC. 9-08:10
		NIGHT	NOV.16-19:24 NOV.17-21:20	NOV. 9-03:39 NOV.12-21:22 NOV.14-19:38 NOV.17-23:47	NOV.18-04:48 DEC. 9-05:16 DEC. 9-22:40 DEC. 9-23:27 DEC.10-05:14
	PICKERING EAST	DAY			NOV. 8-07:42
		NIGHT			NOV. 6-23:18 NOV. 7-00:05

3. Ten lake trout were radiotagged during October, 1987. Eight of the ten immediately left the study area, with two of these being subsequently captured by anglers in New York and Ontario during summer, 1988. One of the two remaining lake trout did not survive the tagging ordeal and washed up on the beach near the Pickering East station eight days later. The last lake trout left the study area within 40 minutes of release, returned 15 days later for approximately two hours. It returned again 24 days after tagging and remained for almost 24 hours prior to its final departure. On both occasions, the trout approached Pickering from the west, making initial contact with the Pickering 'A' receiving station, and continued eastward past the Pickering 'B' and Pickering east stations. These results, combined with results of previous Floy tagging studies, indicate that lake trout range widely throughout Lake Ontario and come into contact with the thermal discharge of power stations in the course of their travels. They do not appear to exhibit any long-term attraction to the thermal plume, but remain in the outer mixing areas within the zone of their thermal preference for short periods of time. It is unlikely that the periods of discharge residency observed during this study would affect the sexual maturation of prespawning adults.

4. Three smallmouth bass were radiotagged and released in the discharge channel of Pickering 'A', while two bass were tagged and released at Pickering 'B'. No interchange of individuals occurred between the two discharges. Bass residency at Pickering 'A' after tagging ranged from approximately two weeks to two months. Equipment failure resulted in the loss of the complete Pickering 'A' data file. Both smallmouth bass at Pickering 'B' remained within the study area for approximately 5 weeks (to December 10, 1987). Similar patterns of discharge residency were observed for these individuals, initially alternating between 2-3 days present or absent from the discharge area. As time progressed, however, periods of absence increased to a maximum of two weeks before the final contact. Temperatures experienced by bass were always at or within a few degrees of the discharge temperature indicating residency within the unmixed portion of the thermal plume. Previous studies indicated that bass are present in the thermal discharge during winter, spring and summer; with a major spawning event occurring within the confines of the Pickering 'B' discharge channel. This study indicates that bass are periodic residents of the thermal plume during late fall/early winter.

Approved by:

D.J.R. Dodd
Manager
Chemical Research Dept

Prepared by:

L.P. King
Survey Technician
Biological Research Section

Reviewed by:

O.T. Melo
Acting Section Head
Biological Research Section

LK

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APPENDIX 1

Radiotelemetry Signal Sorting Program

PROGRAM ANNOTATION

Line 10 clears output devices
Lines 13,17 and 18 set data storage pointer, Xis the pointer variable
Lines 25-55 set date amd clock, clock counter is read using "?"
Lines 60-90 set menu routing
Line 100 sets route for *RUN* command
Line 415 enables output devices
Line 420 sets number of channels to scan
Lines 423,427 and 850 set routine to scan 2 Khz above and below set frequency
Lines 440-470 set frequency to proper format for output
Line 475 sends frequency out on serial line
Line 477 wait 1 second for receiver to settle
Lines 480-545 read timer and update clock
Line 555 checks for memory overflow
Line 700 sets variables to zero
Lines 710-720 gets calibration # and breaks into slope and intercept
Lines 730 and 760 take 5 samples
Line 735 measure time for i period, if none occur in 4 sec., move on
Line 740 convert from computer time to seconds
Line 745 fit to linear regression and truncate
Line 750 sum for average
Line 755 store temperature # for later variance measure
Line 765 determine average and add 5 to least significant digit for roundoff
Line 767 temperature greater than 36 deg ?
Line 768 round to 3 places
Line 770 print out with decimal
Line 775-820 calculate variance
Line 825 if variance greater than 5000, don't store
Line 830 if temperature greater than 25.5 don't store (255 is used to limit storage to one byte)
Line 835 if temperature less than 1.0, don't store
Line 840 store data
Line 850,855 next frequency
Lines 3000-3080 readout data
Lines 4000-4050 display frequencies
Lines 4100-4200 enter and store frequencies and calibration numbers

PROGRAM LISTING

```
 10 PCLR 9
 13 PRINT "DO YOU WANT TO WRITE OVER OLD DATA ?"
 17 INPUT "TYPE '0' FOR NO,'7' FOR YES ",D;
 18 IF D=7 X=0
 20 PRINT
 25 INPUT"TYPE IN DATE (JULIAN DAY) ",D
 30 @(3000)=D
 35 INPUT"TYPE IN TIME -HOURS ",D
 40 @(3001)=D
 45 INPUT"TYPE IN TIME -MIN'S ",D
 50 @(3002)=D
 55 @(3005)=?
 60 PRINT
 62 PRINT"TYPE 0 TO LOG DATA,1 TO READOUT DATA,";
 65 INPUT"2 FOR DATA ENTRY,3 TO STOP "M
 70 IF M=1 GOTO 3000
 80 IF M=2 GOTO 4000
 90 IF M=3 STOP
 95 GOTO 300
100 GOTO 60
300 PRINT"LOGGING DATA"
410 T=0
415 PSET 9
420 FOR N=0 TO 19
423 FOR P=-2 TO 2 STEP2
425 E=@(N+30)
427 E=E+P
430 PRINT#4,"CHAN= ",N," FREQ= ",E;
435 IF E<3 PRINT"   SKIPPED ":GOTO 850
440 A=E/1000
445 B=E-A*1000
450 B=B/100
455 C=E-A*1000-B*100
460 C=C/10
465 D=E%10
470 F=4096*A+256*B+16*C+D
475 SDO F,13
477 SLEEP 0:SLEEP 100
480 K=H
490 U=?-@(3005)
500 D=U/8640000:D=D+@(3000)
510 IF D>365 D=D-365
520 H=U%8640000:H=H/360000:H=H+@(3001)
530 M=U%360000:M=M/6000:M=M+@(3002)
535 H=H+M/60:M=M%60:D=D+H/24:H=H%24
540 PRINT #4,D,"/";
545 PRINT #2,H,":",M," ";
555 IF X>229375 X=0
700 A=0:V=0:C=0
710 VGET@(N)
715 S=@(N)%1000
720 Y=@(N)/1000
730 FOR Q= 0 TO 4
735 G=PERIOD(1,400)
740 G=G*10/12288
745 T=Y-G*S:T=T/100
750 A=A+T
755 @(500+Q)=T
760 NEXT Q
765 A=A/5:T=A:T=T+5
767 IF T>3600 T=0
768 T=T/10
770 PRINT"TEMP= ",T/10,".",T%10;
775 FOR Q=0TO4
780 F=@(500+Q)-A
790 C=C+F*F
800 NEXT Q
810 V=C/4
820 PRINT"  VAR= ",V
825 IF V>5000 GOTO850
830 IF T>255 GOTO850
835 IF T<10 GOTO850
840 STOREX,#2,E:STOREX,#1,T:STOREX,#2,V:STOREX,#2,D:S
850 NEXT P
```

```
 855 NEXT N
 860 GOTO 415
3000 PRINT:PRINT#6,X/9," BLOCKS OF DATA ARE AVAILABLE"
3005 INPUT"PRINT STARTING WITH BLOCK ",K
3010 INPUT"TYPE # OF BLOCKS TO PRINT",L
3015 Y=K*9
3025 FOR I= 1 TO L
3030 F=GET(Y,#2):G=GET(Y,#1):V=GET(Y,#2)
3040 D=GET(Y,#2):H=GET(Y,#1):M=GET(Y,#1)
3050 PRINT #4,D,"/";
3055 PRINT #2,H,":",M;
3060 PRINT #5,F;:PRINT #4,G;:PRINT #5,V
3070 NEXT I
3080 GOTO 60
4000 INPUT"TYPE 0 TO DISPLAY 10 FREQ'S ,1 TO ENTER NEW
4002 IF R=1 GOTO 4100
4005 Z=0:J=0
4010 FOR J=Z TO Z+9
4015 SLEEP 0:SLEEP 50
4020 PRINT"CHANNEL # ",J," FREQ ",@(J+30)," CAL # ",@(
4030 NEXT J
4035 INPUT "TYPE 0 TO DISPLAY NEXT 10,1 TO QUIT ",R
4040 IF R=0 Z=J:GOTO 4010
4050 GOTO 60
4100 Z=0:J=0
4110 PRINT"TYPE NEW FREQ AFTER DISPLAY ELSE [CR] TO AC
4115 PRINT"TYPE 9999 TO ZERO A FREQUENCY"
4120 FOR J=Z TO Z+9
4130 PRINT"CHANNEL # ",J," FREQ ",@(J+30);:INPUT"",F
4140 IF F=0 GOTO 4161
4150 IF F=9999 F=0
4160 @(J+30)=F:GOTO 4130
4161 VGET @(J)
4162 PRINT "CALIBRATION # = ",@(J)
4163 INPUT"",F
4165 IF F=0 GOTO 4170
4167 @(J)=F:VSTORE@(J)
4170 NEXT J
4180 INPUT"TYPE 0 FOR 10 MORE ,1 TO QUIT ",R
4190 IF R=0 Z=J:GOTO 4120
4200 GOTO 60
```

APPENDIX 2

MERISTIC AND CATCH DATA FOR LAKE TROUT AND
SMALLMOUTH BASS TAGGED AT PICKERING NGS, 1987

RADIOTAG FREQUENCY (MHZ)	WEIGHT (GM)	SPECIES	LENGTH (MM)	WEIGHT (GM)	CLIPS	SCARS	TAGGING DATE	GEAR	LOCATION
50.255	48	LAKE TROUT	730	3600	ADIPOSE	LEFT SIDE	OCT 6	GILL NET	PK B DIS-12M
50.289	48	LAKE TROUT	683	3900	ADIPOSE	RIGHT SIDE	OCT 6	GILL NET	PK B DIS-12M
50.299	48	LAKE TROUT	660	3800	R. PECT.	NIL	OCT 6	GILL NET	PK B DIS-12M
50.324	48	LAKE TROUT	667	4500	ADIPOSE	LEFT SIDE	OCT 6	GILL NET	PK B DIS-12M
50.343	48	LAKE TROUT	710	5150	R. PECT.	BELLY	OCT 8	GILL NET	DUFFINS-3M
50.365	48	LAKE TROUT	640	3600	ADIPOSE	NIL	OCT 8	GILL NET	DUFFINS-3M
50.382	48	LAKE TROUT	735	5350	R. PECT.	NIL	OCT 8	GILL NET	SIMCOE-3M
50.404	48	LAKE TROUT	688	4620	R. PECT.	RIGHT SIDE	OCT 8	GILL NET	SIMCOE-3M
50.430	48	LAKE TROUT	710	4200	AD&L.PEC.	BOTH SIDES	OCT 27	GILL NET	PK B DIS-12M
50.494	48	LAKE TROUT	693	4500	AD&R.PEL.	NIL	OCT 27	GILL NET	PK B DIS-12M
50.274	13	SMALLMOUTH BASS	423	1700	NIL	NIL	NOV 2	LANDING NET	PK B DIS
50.332	13	SMALLMOUTH BASS	455	2050	NIL	NIL	NOV 3	LANDING NET	PK A DIS
50.353	13	SMALLMOUTH BASS	448	2000	NIL	NIL	NOV 3	LANDING NET	PK A DIS
50.37	13	SMALLMOUTH BASS	416	1400	NIL	NIL	NOV 3	LANDING NET	PK A DIS
50.414	13	SMALLMOUTH BASS	390	1400	NIL	NIL	NOV 4	LANDING NET	PK B DIS

APPENDIX 3

Calculation of Transmission Losses from a Submerged Transmitter

Total transmission loss consists of:

1) attenuation due to the conductivity of the water
2) the spreading effect plus the refractive effects at the air-water interface and
3) the inverse distance-squared loss between signal emergence from the water and the distance to the receiving antenna.

Example Calculation

Reference transmitter, Trial 2

1) Water conductivity losses

Transmitter frequency	= 50.4 mHz
Transmitter depth	= 6.0 m
Water temperature	= 8.0°C
Water conductivity	= 325 μM/m

then loss (from figure 5a & 5b, Velle et al, 1979) is 6 db/meter of water = 36 db at the 6 m depth.

2) Refraction and Spreading losses

Antenna height = 6.0 m
Reception distance = 200 m

Require θ , which is the viewing angle in air, as measured from a line perpendicular to the interface. In this example $\theta = 90° - 1.7°$ (angle between air-water interface and line between antenna & location of signal emergence) = 88.3°. From Figure 4b, (Velle et al, 1979), refraction and spreading loss is ≈ 35 db.

3) Basic path loss = $10 \log_{10} \frac{\lambda^2}{16\pi^2 R^2}$

where λ = wavelength = 6 m

and R = distance from a point on the surface just above the transmitter to the receiver = 200 m

= 52.4 db

4) Total loss then equals

$$(36 + 35 + 52.4) = 123.4 \approx 123 \text{ db}$$

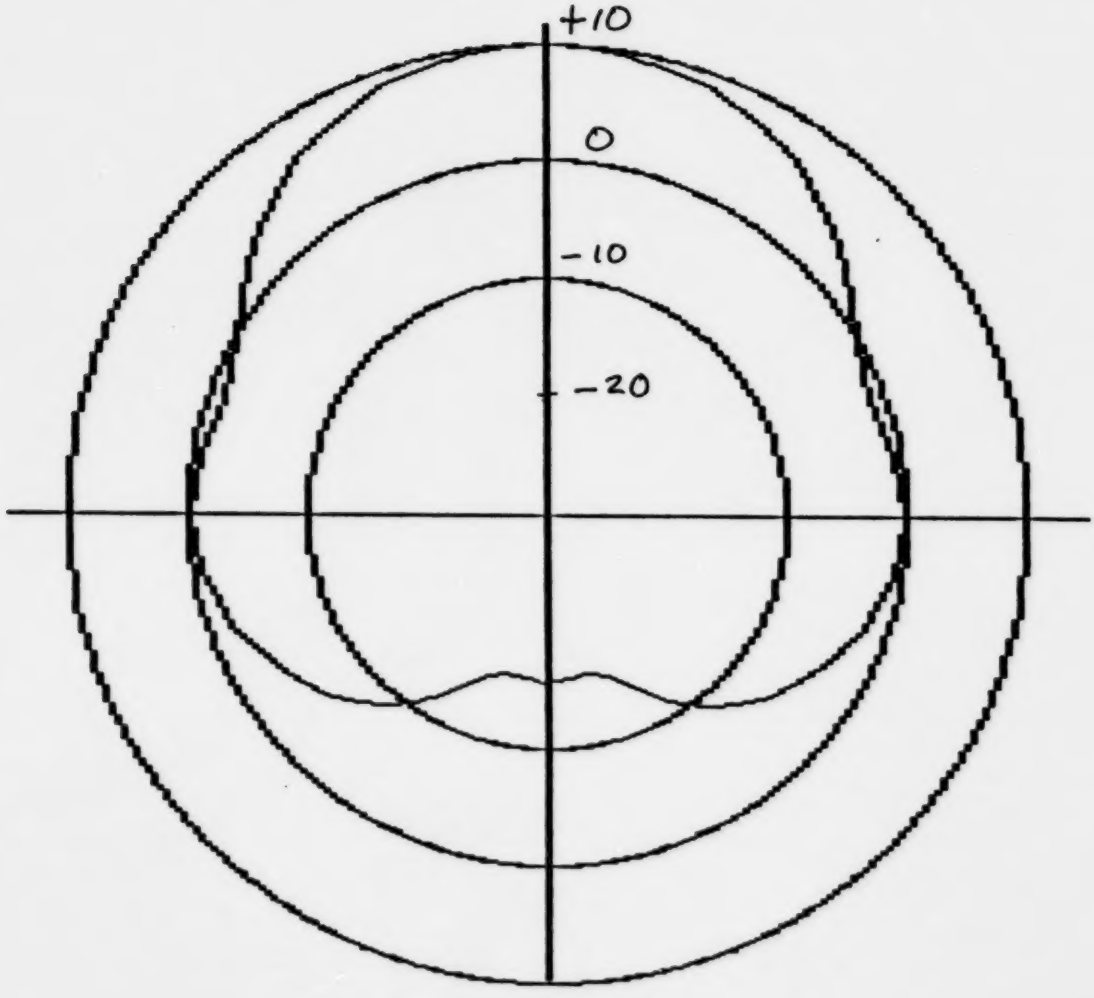
between a tag located in 6 m of water and an antenna at a distance of 200 m and height of 6 m.

APPENDIX 4

AZIMUTH-PLANE MEASUREMENTS FOR A TELEX HY-GAIN MODEL 64B-S, 50.5 MHz, ANTENNA
(from Cedar Creek Bioelectronics Laboratory Ltd.)

ANGLE (degrees)	GAIN	ANGLE (degrees)	GAIN
0	9.913389	180	-15.6739
5	9.849202	185	-15.77578
10	9.655227	190	-15.97586
15	9.327240	195	-15.95195
20	8.858314	200	-15.30841
25	8.239055	205	-13.97215
30	7.458300	210	-12.26525
35	6.504839	215	-10.52221
40	5.371614	220	-8.904581
45	4.065397	225	-7.450424
50	2.627920	230	-6.145536
55	1.173638	235	-4.96389
60	-.0748404	240	-3.887005
65	-.8460826	245	-2.911843
70	-1.037943	250	-2.050837
75	-.833649	255	-1.327041
80	-.5166856	260	-.7676738
85	-.2863723	265	-.398265
90	-.2369806	270	-.2369821
95	-.3982635	275	-.2863737
100	-.7676703	280	-.5166856
105	-1.327044	285	-.8336471
110	-2.050846	290	-.1.037944
115	-2.911847	295	-.8460865
120	-3.887004	300	-.0748358
125	-4.963901	305	1.173647
130	-6.145543	310	2.627932
135	-7.450422	315	4.065422
140	-8.904587	320	5.371628
145	-10.52223	325	6.504843
150	-12.26525	330	7.458304
155	-13.97216	335	8.239056
160	-15.30838	340	8.858320
165	-15.95194	345	9.327241
170	-15.97586	350	9.655225
175	-15.77583	355	9.849204

AZIMUTH-PLANE PATTERN OF TELEX HY-GAIN
MODEL 64B-S INDICATING FORWARD GAIN (dB)



APPENDIX 5

HISTORY OF AUTOMATED TELEMETRY RECEIVING STATIONS OPERATION, 1987/88

DATE	STATION	COMMENTS
Oct 5/87	All	Stations activated
Oct 27/87	Pk Intake	DCC hung, unresponsive to commands from Tandy 102. Returned to lab.
Oct 29/87	Pk Intake	Operating program reloaded following failed attempt to communicate between DCC and terminal, data lost.
Nov 2/87	Pk Intake	DCC returned to service, operation normal
Nov 3/87	Pk Intake	Top halves of elements D1 and D2 broken off.
Nov 9/87	Pk Intake	DCC hung, unresponsive. Removed from service.
Nov 13/87	Pk Intake	DCC returned to service, operation normal.
Nov 16/87	Pk Intake	DCC hung, restarted in response to terminal commands. Operation appears normal.
Dec 7/87	Pk Intake	Operation normal until connection made with remote terminal (Tandy 102). Operation ceased, DCC unresponsive. Removed from service, station deactivated.
Jan 7/88	Pk East	Station deactivated, no operational problems.
	Pk A Dis	DCC removed to download data (16064 lines as of this date), replaced with unit from Pk East.
Jan 15/88	Pk A Dis	Failure of DCC removed from service on Jan 7 to communicate or transfer data, data lost.
	Pk B Dis	Data transferred from DCC to COMPAQ and stored on disk. DCC returned to service. Top and bottom half of element D2 broken from antenna.
Jan 22/88	Pk B Dis	Reflector element of antenna rotated out of alignment with remaining elements.
Feb 16/88	Pk B Dis Pk A Dis	Both stations deactivated, units removed from service.

APPENDIX 6

Radiotag.Bas Program Listing

```
10    REM VERSION 1.00 RADIOTAG SOFTWARE TO SORT TAGS RECORDED
20    REM FROM REMOTE DATA ACQUISITION OF RADIOTELEMETRY DATA
30    REM AND STORES EACH TAG TO A FILE
40    REM BLAIR F. SIM
50    CLS
60    CLEAR
70    INPUT "FILE TO PROCESS:":PF$
80    INPUT "ANOTHER FILE TO PROCESS:(Y/N)";MPF$
90    OPEN "I",#1,PF$
100   OPEN "I", #2,PF$
110   OPEN "I", #3,PF$
120   INPUT #2,L$
130   INPUT #1,Z$
140   INPUT #3,R$
150   IF LEFT$(L$,2)="L:"THEN GOTO 170 ELSE GOTO 160
160   GOTO 120
170   NO=VAL(RIGHT$(L$,4))
180   PRINT NO
190   OPTION BASE 1
200   J=6
210   0=NO
220   DIM A(O,J)
230   FOR 0=1 TO NO
240   LOCATE 4,1
250   PRINT "0="0
260   INPUT #1,Z$
270   IF EOF (1) THEN GOTO 500
280                 DAY$=""
290         HR$=""
300         MIN$=""
310         FOR I=1 TO 5
320                         D$=INPUT$(1,#3)
330                         DAY$=DAY$+D$
340         NEXT I
350         FOR I=1 TO 3
360                         H$=INPUT$(1,#3)
370                         HR$=HR$+H$
380         NEXT I
390         FOR I=1 TO 3
400                         M$=INPUT$(1,#3)
410                         MIN$=MIN$+M$
420         NEXT I
430   INPUT #3,F,TEMP,V
440   A(0,1)=0
450   A(0,2)=VAL(DAY$)
460   A(0,3)=((VAL(HR$)*60)+VAL(MIN$))/60
470   A(0,4)=F
480   A(0,5)=TEMP*.1
```

```
490     A(0,6)=V
500     NEXT 0
510     CLOSE #1
520     CLOSE #2
530     CLOSE #3
540     INPUT "NUMBER OF FREQUENCIES TO SORT:";S
550     C=S
560     FOR C=1 TO S
570     LOCATE 7,1
580     CLS
590     PRINT "C="C
600     INPUT "FILE NAME TO SAVE DATA TO:";SFN$
610     OPEN "O", #1 SFN$
620     INPUT "TRANSMITTER FREQUENCY;":H
630     T=O
640     HZ=H
650     FOR 0=1 TO NO
660             LOCATE 10,1
670             PRINT "0="0
680             IF A(0,4)=(HZ-2) OR A(0,4)=HZ OR A(0,4)=(HZ+2) THEN GOTO 690 ELSE GOTO
                750
690             T=T+1
700             PRINT #1,USING " #### "; A(0,1), T, A(0,2);
710             PRINT #1,USING " ##.## "A(0,3);
720             PRINT #1,USING " #### "; A(0,4);
730             PRINT #1,USING " ##.## ';A(0,5);
740             PRINT #1,USING " #### ";A(0,6)
750             NEXT 0
760             CLOSE #1
770     NEXT C
780     IF MPF$="Y" THEN GOTO 50 ELSE GOTO 790
790     END
```

SCREEN PROMPTS

FIRST: SCREEN

```
FILE TO PROCESS?  A:PKBDIS.PRN
ANOTHER FILE TO PROCESS:(Y/N)? N
1982                                    -   number of data llines in file
0=1982                                  -   count of processed lines
NUMBER OF FREQUENCIES TO SORT:? 8
                                        -   number of transmitter
                                            tags to sort
```

NEXT SCREEN

C=1

	-	transmitter tag sort
FILE NAME TO SAVE DATA TO:? 1255.PRN	-	file to save data in
TRANSMITTER FREQUENCY:?	-	transmitter frequency sorted
0=394	-	line count to sort

NEXT SCREEN: Next Tag

C=2
FILE NAME TO SAVE DATA TO:?

Sample of Parsed and labeled data obtained from PKBDIS.PRN
for Radiotag frequency 1255

Original Data Line No.	New Line No.	Day	Time (Hr)	Frequency (BW +/-2 KHz)	Temperature	Variance
17	1	279	12.67	1253	21	52
18	2	279	12.67	1255	21.2	41
19	3	279	12.8	1253	19.7	60
20	4	279	12.8	1255	19.6	34
21	5	279	12.93	1253	12.5	25
22	6	279	12.93	1255	12.6	9
25	7	279	13.05	1253	13.2	56
26	8	279	13.05	1255	13.2	21
29	9	279	13.18	1253	12.9	54
30	10	279	13.18	1255	12.9	4
33	11	279	13.3	1253	13.6	114
34	12	279	13.3	1255	13.6	16
39	13	279	13.42	1253	13.5	26
40	14	279	13.43	1255	13.7	42
41	15	279	13.43	1257	13.7	82
478	16	294	6.38	1253	11.4	50
482	17	304	19.2	1253	12.9	17
483	18	304	19.37	1253	14.7	60

APPENDIX 7
LAKE TROUT AND SMALLMOUTH BASS
RADIOTELEMETRY CONTACTS
PICKERING A DISCHARGE

JULIAN DAY	DATE	TIME	RADIOTAG FREQUENCY	TEMP. (C)	VARIANCE	DATA LINE NUMBER	DATE OF DATA TRANSFER
279	OCT 6/87	13:59	50.255	7.3	1120	1	OCT 13/87
294	OCT 21/87	04:39	50.253	13.4	290	2	NOV 2/87
294	OCT 21/87	05:03	50.255	12.3	143	3	NOV 2/87
294	OCT 21/87	05:11	50.253	12.3	183	4	NOV 2/87
294	OCT 21/87	05:11	50.255	12.5	65	5	NOV 2/87
294	OCT 21/87	05:19	50.255	11.6	3	6	NOV 2/87
303	OCT 30/87	20:07	50.253	14.0	179	7	NOV 2/87
303	OCT 30/87	20:07	50.255	14.0	29	8	NOV 2/87
303	OCT 30/87	20:17	50.253	13.4	196	9	NOV 2/87
303	OCT 30/87	20:17	50.255	13.6	52	10	NOV 2/87
303	OCT 30/87	20:17	50.257	13.8	6	11	NOV 2/87
304	OCT 31/87	18:26	50.255	12.0	29	12	NOV 2/87
311	NOV 7/87	12:28	50.329	16.5		2160	NOV 9/87
314	NOV 10/87	03:04	50.372	16.5	24	2500	NOV 16/87
314	NOV 10/87	03:16	50.329	15.9	18	2501	NOV 16/87
314	NOV 10/87	03:16	50.331	15.9	9	2502	NOV 16/87
315	NOV 11/87	07:24	50.351	17	12	3500	NOV 16/87
315	NOV 11/87	07:24	50.353	17	20	3501	NOV 16/87
315	NOV 11/87	07:25	50.368	17.3	11	3502	NOV 16/87
315	NOV 11/87	07:25	50.37	17.3	6	3503	NOV 16/87
316	NOV 12/87	13:25	50.37	7.5	15	4500	NOV 16/87
316	NOV 12/87	13:31	50.367		16	4501	NOV 16/87
316	NOV 12/87	13:37	50.329	17.1	38	4502	NOV 16/87
316	NOV 12/87	13:37	50.331	17.1	11	4503	NOV 16/87
317	NOV 13/87	23:43	50.353	14.5	10	5500	NOV 16/87
317	NOV 13/87	23:44	50.368	12.4	8	5501	NOV 16/87
317	NOV 13/87	23:44	50.37	12.4	6	5502	NOV 16/87
317	NOV 13/87	23:44	50.372	12.4	65	5503	NOV 16/87
317	NOV 13/87	23:56	50.351	17.2	14	5504	NOV 16/87
319	NOV 15/87	21:58	50.367		46	6500	NOV 16/87
319	NOV 15/87	22:03	50.329	13.1	15	6501	NOV 16/87
319	NOV 15/87	22:03	50.331	13.1	14	6502	NOV 16/87
319	NOV 15/87	22:03	50.333	13.1	44	6503	NOV 16/87
329	NOV 25/87	06:29	50.367		51	9000	NOV 26/87
329	NOV 25/87	06:37	50.368	17.2	15	9001	NOV 26/87
329	NOV 25/87	06:37	50.37	17.2	11	9002	NOV 26/87
329	NOV 25/87	06:37	50.372	17.2	65	9003	NOV 26/87
329	NOV 25/87	06:51	50.368	17.7	15	9004	NOV 26/87
329	NOV 25/87	06:51	50.37	17.7	15	9005	NOV 26/87
340	DEC 6/87	13:36	50.368	16.7	6	12000	DEC 7/87
340	DEC 6/87	13:36	50.37	16.8	7	12001	DEC 7/87
340	DEC 6/87	13:42	50.367		15	12002	DEC 7/87
340	DEC 6/87	13:50	50.368	13.8	22	12003	DEC 7/87
341	DEC 7/87	09:49	50.37	17.3	2564	12268	DEC 7/87

341	DEC 7/87	10:09	50.367	194	12269	DEC 7/87
7	JAN 7/88 *				16064	JAN 7/88
7	JAN 7/88 *				1442	JAN 7/88
22	JAN 22/88*				1442	JAN 22/88
47	FEB 16/88*				1442	FEB 16/88

* DATA COLLECTION COMPUTER REPLACED JAN 7/88 WITH UNIT FROM PK EAST LOCATION, 1442 PREVIOUS LINES OF DATA

APPENDIX 7 (CONT.)

RADIOTELEMETRY CONTACTS
PICKERING INTAKE

JULIAN DAY	DATE	TIME	RADIOTAG FREQUENCY	TEMP. (C)	VARIANCE	DATA LINE NUMBER	DATE OF DATA TRANSFER
279	OCT 6/87	13:26	50.257	13.9	719	1	OCT 13/87
279	OCT 6/87	13:27	50.297	13.9	35	2	OCT 13/87
279	OCT 6/87	13:49	50.257	6.5	144	3	OCT 13/87
279	OCT 6/87	14:05	50.253	7.9	11	4	OCT 13/87
279	OCT 6/87	14:05	50.255	7.8	6	5	OCT 13/87
279	OCT 6/87	14:05	50.257	7.8	81	6	OCT 13/87
279	OCT 6/87	14:06	50.291	7.8	109	7	OCT 13/87
279	OCT 6/87	14:12	50.253	8.7	34	8	OCT 13/87
279	OCT 6/87	14:29	50.257	6.9	188	9	OCT 13/87
279	OCT 6/87	14:37	50.255	7.1	17	10	OCT 13/87
279	OCT 6/87	15:03	50.291	7.5	52	11	OCT 13/87
279	OCT 6/87	15:18	50.253	6.6	92	12	OCT 13/87
279	OCT 6/87	15:18	50.257	6.5	109	13	OCT 13/87
279	OCT 6/87	15:26	50.257	6.4	218	14	OCT 13/87
279	OCT 6/87	15:49	50.255	6.4	299	15	OCT 13/87
279	OCT 6/87	15:58	50.257	6.4	148	16	OCT 13/87
279	OCT 6/87	16:06	50.255	6.5	4	17	OCT 13/87
279	OCT 6/87	16:22	50.257	6.5	440	18	OCT 13/87
279	OCT 6/87	16:37	50.255	6.5	6	19	OCT 13/87
279	OCT 6/87	16:45	50.255	6.5	13	20	OCT 13/87
279	OCT 6/87	16:53	50.255	6.6	95	21	OCT 13/87
279	OCT 6/87	17:00	50.253	6.6	19	22	OCT 13/87
279	OCT 6/87	21:27	50.291	9.9	348	23	OCT 13/87
280	OCT 7/87	06:07	50.287	10.2	188	24	OCT 13/87
DCC STOPPED OCT 27/87; RESTARTED NOV 2/87							
DCC STOPPED NOV 9/87; RESTARTED NOV 13/87							
DCC STOPPED NOV 16/87; RESTARTED SAME DAY							
320	NOV 16/87	13:14	50.37	13.8	570	1	NOV 26/87
320	NOV 16/87	19:48	50.333	12.3	84	2	NOV 26/87
321	NOV 17/87	15:01	50.372	12.9	405	3	NOV 26/87
321	NOV 17/87	15:36	50.372	12.7	227	4	NOV 26/87
321	NOV 17/87	16:21	50.368	12.9	15	5	NOV 26/87
321	NOV 17/87	19:59	50.37	12.4	3652	6	NOV 26/87
321	NOV 17/87	20:11	50.372	12.8	481	7	NOV 26/87
321	NOV 17/87	20:34	50.368	12.8	83	8	NOV 26/87
DCC MALFUNCTION DEC 7/87; REMOVED FROM SERVICE							

APPENDIX 7 (CONT.)

RADIOTELEMETRY CONTACTS
PICKERING B DISCHARGE

JULIAN DAY	DATE	TIME	RADIOTAG FREQUENCY	TEMP. (C)	VARIANCE	DATA LINE NUMBER	DATE OF DATA TRANSFER
279	OCT 6/87	9 : 3	1289	226	75	1	JAN 15/88
279	OCT 6/87	9 :11	1289	215	90	2	JAN 15/88
279	OCT 6/87	9 :19	1287	203	9	3	JAN 15/88
279	OCT 6/87	9 :19	1289	203	70	4	JAN 15/88
279	OCT 6/87	9 :28	1289	194	11	5	JAN 15/88
279	OCT 6/87	9 :36	1287	189	15	6	JAN 15/88
279	OCT 6/87	9 :36	1289	189	45	7	JAN 15/88
279	OCT 6/87	9 :44	1287	185	11	8	JAN 15/88
279	OCT 6/87	9 :44	1289	185	33	9	JAN 15/88
279	OCT 6/87	11 :26	1289	154	21	10	JAN 15/88
279	OCT 6/87	11 :34	1289	155	42	11	JAN 15/88
279	OCT 6/87	12 : 0	1289	167	53	12	JAN 15/88
279	OCT 6/87	12 : 8	1289	179	34	13	JAN 15/88
279	OCT 6/87	12 :16	1289	193	15	14	JAN 15/88
279	OCT 6/87	12 :33	1287	197	24	15	JAN 15/88
279	OCT 6/87	12 :33	1289	197	17	16	JAN 15/88
279	OCT 6/87	12 :40	1253	210	52	17	JAN 15/88
279	OCT 6/87	12 :40	1255	212	41	18	JAN 15/88
279	OCT 6/87	12 :48	1253	197	60	19	JAN 15/88
279	OCT 6/87	12 :48	1255	196	34	20	JAN 15/88
279	OCT 6/87	12 :56	1253	125	25	21	JAN 15/88
279	OCT 6/87	12 :56	1255	126	9	22	JAN 15/88
279	OCT 6/87	12 :56	1287	219	134	23	JAN 15/88
279	OCT 6/87	12 :56	1289	218	33	24	JAN 15/88
279	OCT 6/87	13 : 3	1253	132	56	25	JAN 15/88
279	OCT 6/87	13 : 3	1255	132	21	26	JAN 15/88
279	OCT 6/87	13 : 4	1289	196	79	27	JAN 15/88
279	OCT 6/87	13 : 4	1291	196	121	28	JAN 15/88
279	OCT 6/87	13 :11	1253	129	54	29	JAN 15/88
279	OCT 6/87	13 :11	1255	129	4	30	JAN 15/88
279	OCT 6/87	13 :12	1289	148	55	31	JAN 15/88
279	OCT 6/87	13 :12	1291	148	238	32	JAN 15/88
279	OCT 6/87	13 :18	1253	136	114	33	JAN 15/88
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279	OCT 6/87	13 :19	1289	149	15	35	JAN 15/88
279	OCT 6/87	13 :19	1291	148	217	36	JAN 15/88
279	OCT 6/87	13 :20	1299	140	15	37	JAN 15/88
279	OCT 6/87	13 :20	1301	140	260	38	JAN 15/88
279	OCT 6/87	13 :25	1253	135	26	39	JAN 15/88
279	OCT 6/87	13 :26	1255	137	42	40	JAN 15/88
279	OCT 6/87	13 :26	1257	137	82	41	JAN 15/88
279	OCT 6/87	13 :26	1289	149	37	42	JAN 15/88
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279	OCT 6/87	13 :27	1301	139	26	45	JAN 15/88
279	OCT 6/87	13 :34	1289	81	13	46	JAN 15/88

279	OCT 6/87	13 :34	1291	81	38	47	JAN 15/88
279	OCT 6/87	13 :35	1299	150	117	48	JAN 15/88
279	OCT 6/87	13 :35	1301	148	534	49	JAN 15/88
279	OCT 6/87	13 :43	1299	63	33	50	JAN 15/88
279	OCT 6/87	13 :49	1289	78	13	51	JAN 15/88
279	OCT 6/87	13 :50	1291	78	14	52	JAN 15/88
279	OCT 6/87	13 :51	1324	137	49	53	JAN 15/88
279	OCT 6/87	13 :51	1326	138	110	54	JAN 15/88
279	OCT 6/87	14 : 6	1289	78	4	55	JAN 15/88
279	OCT 6/87	14 : 6	1291	78	48	56	JAN 15/88
279	OCT 6/87	14 :14	1289	76	47	57	JAN 15/88
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279	OCT 6/87	14 :56	1291	75	29	63	JAN 15/88
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280	OCT 7/87	4 : 0	1287	110	6	167 JAN 15/88
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280	OCT 7/87	4 : 9	1289	113	127	169 JAN 15/88
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280	OCT 7/87	5 :22	1287	107	9	184 JAN 15/88
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280	OCT 7/87	5 :47	1289	105	146	191 JAN 15/88
280	OCT 7/87	5 :55	1287	104	30	192 JAN 15/88
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281	OCT 8/87	4 :39	1287	90	4	332	JAN 15/88
281	OCT 8/87	4 :56	1287	90	7	333	JAN 15/88
281	OCT 8/87	5 : 4	1287	89	61	334	JAN 15/88
281	OCT 8/87	5 :21	1287	90	0	335	JAN 15/88
281	OCT 8/87	5 :29	1287	89	86	336	JAN 15/88
281	OCT 8/87	5 :37	1287	89	22	337	JAN 15/88
281	OCT 8/87	5 :46	1287	89	26	338	JAN 15/88
281	OCT 8/87	5 :54	1287	89	50	339	JAN 15/88
281	OCT 8/87	6 : 2	1287	89	21	340	JAN 15/88
281	OCT 8/87	6 :11	1287	89	32	341	JAN 15/88
281	OCT 8/87	6 :19	1287	89	20	342	JAN 15/88
281	OCT 8/87	6 :28	1287	89	29	343	JAN 15/88
281	OCT 8/87	6 :36	1287	90	18	344	JAN 15/88
281	OCT 8/87	6 :53	1287	90	45	345	JAN 15/88
281	OCT 8/87	9 :50	1287	89	34	346	JAN 15/88
281	OCT 8/87	10 : 7	1287	89	64	347	JAN 15/88
281	OCT 8/87	10 :15	1287	89	9	348	JAN 15/88
281	OCT 8/87	10 :24	1287	89	38	349	JAN 15/88
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281	OCT 8/87	11 :22	1287	90	16	352	JAN 15/88
281	OCT 8/87	11 :30	1287	90	102	353	JAN 15/88
281	OCT 8/87	11 :39	1287	91	47	354	JAN 15/88
281	OCT 8/87	11 :47	1287	91	4	355	JAN 15/88
281	OCT 8/87	11 :55	1287	91	10	356	JAN 15/88
281	OCT 8/87	11 :55	1289	91	68	357	JAN 15/88
281	OCT 8/87	12 : 3	1287	92	66	358	JAN 15/88
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281	OCT 8/87	12 :37	1289	91	191	364	JAN 15/88
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281	OCT 8/87	13 :10	1287	91	6	367	JAN 15/88
281	OCT 8/87	13 :18	1287	91	36	368	JAN 15/88
281	OCT 8/87	13 :18	1289	91	158	369	JAN 15/88
281	OCT 8/87	13 :26	1289	91	108	370	JAN 15/88
281	OCT 8/87	13 :34	1289	91	79	371	JAN 15/88
281	OCT 8/87	13 :43	1289	91	144	372	JAN 15/88
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281	OCT 8/87	13 :59	1289	91	103	374	JAN 15/88
281	OCT 8/87	14 :15	1341	92	2	375	JAN 15/88
281	OCT 8/87	14 :17	1365	87	80	376	JAN 15/88
281	OCT 8/87	14 :17	1380	83	14	377	JAN 15/88
281	OCT 8/87	14 :18	1402	123	17	378	JAN 15/88
281	OCT 8/87	14 :18	1404	123	6	379	JAN 15/88
281	OCT 8/87	14 :20	1289	90	49	380	JAN 15/88
281	OCT 8/87	14 :34	1402	136	9	381	JAN 15/88
281	OCT 8/87	14 :34	1404	136	112	382	JAN 15/88

281	OCT 8/87	14 :36	1289	90	47	383	JAN 15/88
281	OCT 8/87	14 :42	1402	97	34	384	JAN 15/88
281	OCT 8/87	14 :50	1402	92	32	385	JAN 15/88
281	OCT 8/87	16 : 8	1289	86	20	386	JAN 15/88
291	OCT 8/87	22 : 9	1287	86	11	387	JAN 15/88
281	OCT 8/87	22 :26	1287	85	33	388	JAN 15/88
281	OCT 8/87	22 :51	1287	86	65	389	JAN 15/88
281	OCT 8/87	23 : 8	1287	86	20	390	JAN 15/88
281	OCT 8/87	23 :16	1287	86	23	391	JAN 15/88
281	OCT 8/87	23 :33	1287	85	19	392	JAN 15/88
281	OCT 8/87	23 :41	1287	86	35	393	JAN 15/88
281	OCT 8/87	23 :50	1287	85	11	394	JAN 15/88
281	OCT 8/87	23 :58	1287	85	24	395	JAN 15/88
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282	OCT 9/87	0 :23	1287	85	21	397	JAN 15/88
282	OCT 9/87	0 :40	1287	84	57	398	JAN 15/88
282	OCT 9/87	0 :48	1287	84	69	399	JAN 15/88
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282	OCT 9/87	1 :21	1287	82	28	402	JAN 15/88
282	OCT 9/87	1 :46	1287	81	29	403	JAN 15/88
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282	OCT 9/87	3 :34	1287	80	45	415	JAN 15/88
282	OCT 9/87	3 :43	1287	80	39	416	JAN 15/88
282	OCT 9/87	3 :51	1287	79	2	417	JAN 15/88
282	OCT 9/87	4 : 8	1287	79	56	418	JAN 15/88
282	OCT 9/87	4 :16	1287	79	35	419	JAN 15/88
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282	OCT 9/87	5 : 6	1287	77	65	421	JAN 15/88
282	OCT 9/87	5 :39	1287	78	26	422	JAN 15/88
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282	OCT 9/87	8 :51	1287	80	53	436	JAN 15/88
282	OCT 9/87	9 :16	1287	81	11	437	JAN 15/88
282	OCT 9/87	9 :24	1287	80	32	438	JAN 15/88

282	OCT 9/87	9 :33	1287	80	42	439	JAN 15/88
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282	OCT 9/87	11 :22	1287	139	103	442	JAN 15/88
282	OCT 9/87	13 : 3	1287	167	20	443	JAN 15/88
282	OCT 9/87	13 :11	1287	183	60	444	JAN 15/88
282	OCT 9/87	13 :19	1287	186	37	445	JAN 15/88
282	OCT 9/87	13 :36	1287	183	58	446	JAN 15/88
282	OCT 9/87	13 :44	1287	185	16	447	JAN 15/88
282	OCT 9/87	13 :52	1287	184	2	448	JAN 15/88
282	OCT 9/87	14 : 0	1287	189	33	449	JAN 15/88
282	OCT 9/87	14 : 8	1287	188	30	450	JAN 15/88
282	OCT 9/87	14 :17	1287	186	13	451	JAN 15/88
282	OCT 9/87	14 :25	1287	185	52	452	JAN 15/88
282	OCT 9/87	14 :33	1287	184	18	453	JAN 15/88
282	OCT 9/87	14 :41	1287	187	24	454	JAN 15/88
282	OCT 9/87	14 :49	1287	185	30	455	JAN 15/88
282	OCT 9/87	14 :58	1287	186	11	456	JAN 15/88
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282	OCT 9/87	15 :30	1287	184	11	459	JAN 15/88
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282	OCT 9/87	15 :55	1287	182	24	462	JAN 15/88
282	OCT 9/87	16 : 3	1287	182	21	463	JAN 15/88
282	OCT 9/87	16 :19	1287	180	247	464	JAN 15/88
282	OCT 9/87	16 :27	1287	181	23	465	JAN 15/88
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282	OCT 9/87	17 : 0	1287	179	66	469	JAN 15/88
282	OCT 9/87	17 : 0	1289	178	84	470	JAN 15/88
282	OCT 9/87	17 : 8	1287	174	24	471	JAN 15/88
282	OCT 9/87	17 :16	1287	153	89	472	JAN 15/88
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282	OCT 9/87	17 :49	1287	175	119	475	JAN 15/88
282	OCT 9/87	17 :49	1289	175	12	476	JAN 15/88
282	OCT 9/87	17 :57	1287	175	91	477	JAN 15/88
294	OCT 21/87	6 :23	1253	114	50	478	JAN 15/88
300	OCT 27/87	11 :25	1492	128	11	479	JAN 15/88
300	OCT 27/87	11 :36	1492	86	6	480	JAN 15/88
300	OCT 27/87	11 :57	1492	89	12	481	JAN 15/88
304	OCT 31/87	19 :12	1253	129	17	482	JAN 15/88
304	OCT 31/87	19 :22	1253	147	60	483	JAN 15/88
306	NOV 2/87	14 :36	1272	215	34	484	JAN 15/88
306	NOV 2/87	14 :47	1272	215	6	485	JAN 15/88
306	NOV 2/87	14 :58	1272	215	54	486	JAN 15/88
306	NOV 2/87	15 :10	1272	214	9	487	JAN 15/88
306	NOV 2/87	15 :21	1272	211	21	488	JAN 15/88
306	NOV 2/87	15 :33	1272	212	29	489	JAN 15/88
306	NOV 2/87	15 :44	1272	210	30	490	JAN 15/88
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306	NOV 2/87	16 : 7	1272	209	39	492	JAN 15/88
306	NOV 2/87	16 :29	1272	210	26	493	JAN 15/88
306	NOV 2/87	16 :41	1272	209	7	494	JAN 15/88

306	NOV 2/87	16 :52	1272	208	14	495	JAN 15/88
306	NOV 2/87	17 : 3	1272	209	22	496	JAN 15/88
306	NOV 2/87	17 :15	1272	209	46	497	JAN 15/88
306	NOV 2/87	17 :26	1272	209	12	498	JAN 15/88
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306	NOV 2/87	17 :49	1272	211	42	500	JAN 15/88
306	NOV 2/87	18 :11	1272	211	13	501	JAN 15/88
306	NOV 2/87	18 :22	1272	211	8	502	JAN 15/88
306	NOV 2/87	18 :34	1272	211	34	503	JAN 15/88
306	NOV 2/87	18 :45	1272	211	11	504	JAN 15/88
306	NOV 2/87	18 :57	1272	211	2	505	JAN 15/88
306	NOV 2/87	19 : 8	1272	211	12	506	JAN 15/88
306	NOV 2/87	19 :19	1272	211	26	507	JAN 15/88
306	NOV 2/87	19 :31	1272	211	9	508	JAN 15/88
306	NOV 2/87	19 :42	1272	211	6	509	JAN 15/88
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306	NOV 2/87	20 : 5	1272	211	19	511	JAN 15/88
306	NOV 2/87	20 :16	1272	211	2	512	JAN 15/88
306	NOV 2/87	20 :27	1272	210	20	513	JAN 15/88
306	NOV 2/87	20 :39	1272	211	11	514	JAN 15/88
306	NOV 2/87	20 :50	1272	211	21	515	JAN 15/88
306	NOV 2/87	21 : 1	1272	211	8	516	JAN 15/88
306	NOV 2/87	21 :13	1272	211	6	517	JAN 15/88
306	NOV 2/87	21 :24	1272	210	2	518	JAN 15/88
306	NOV 2/87	21 :35	1272	210	11	519	JAN 15/88
306	NOV 2/87	21 :47	1272	210	5	520	JAN 15/88
306	NOV 2/87	21 :58	1272	210	15	521	JAN 15/88
306	NOV 2/87	22 : 9	1272	210	7	522	JAN 15/88
306	NOV 2/87	22 :21	1272	209	29	523	JAN 15/88
306	NOV 2/87	22 :32	1272	210	16	524	JAN 15/88
306	NOV 2/87	22 :43	1272	210	3	525	JAN 15/88
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306	NOV 2/87	23 :17	1272	209	21	527	JAN 15/88
306	NOV 2/87	23 :29	1272	209	72	528	JAN 15/88
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306	NOV 2/87	23 :51	1272	209	11	530	JAN 15/88
307	NOV 3/87	0 : 3	1272	209	24	531	JAN 15/88
307	NOV 3/87	0 :14	1272	209	6	532	JAN 15/88
307	NOV 3/87	0 :37	1272	208	8	533	JAN 15/88
307	NOV 3/87	0 :48	1272	207	22	534	JAN 15/88
307	NOV 3/87	0 :59	1272	207	11	535	JAN 15/88
307	NOV 3/87	1 :11	1272	206	15	536	JAN 15/88
307	NOV 3/87	1 :22	1272	206	19	537	JAN 15/88
307	NOV 3/87	1 :34	1272	206	9	538	JAN 15/88
307	NOV 3/87	1 :45	1272	204	4	539	JAN 15/88
307	NOV 3/87	1 :56	1272	204	29	540	JAN 15/88
307	NOV 3/87	2 : 8	1272	206	9	541	JAN 15/88
307	NOV 3/87	2 :19	1272	206	14	542	JAN 15/88
307	NOV 3/87	2 :30	1272	206	6	543	JAN 15/88
307	NOV 3/87	2 :42	1272	207	24	544	JAN 15/88
307	NOV 3/87	2 :53	1272	207	20	545	JAN 15/88
307	NOV 3/87	3 : 4	1272	207	6	546	JAN 15/88
307	NOV 3/87	3 :16	1272	207	29	547	JAN 15/88
307	NOV 3/87	3 :39	1272	207	15	548	JAN 15/88
307	NOV 3/87	3 :50	1272	207	17	549	JAN 15/88
307	NOV 3/87	4 : 1	1272	208	21	550	JAN 15/88

307	NOV 3/87	4 :12	1272	208	12	551	JAN 15/88
307	NOV 3/87	4 :13	1274	208	6	552	JAN 15/88
307	NOV 3/87	4 :35	1272	207	13	553	JAN 15/88
307	NOV 3/87	4 :58	1272	207	6	554	JAN 15/88
307	NOV 3/87	5 : 9	1272	207	12	555	JAN 15/88
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307	NOV 3/87	5 :32	1272	207	22	557	JAN 15/88
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307	NOV 3/87	5 :54	1272	207	4	559	JAN 15/88
307	NOV 3/87	6 : 5	1272	208	39	560	JAN 15/88
307	NOV 3/87	6 :17	1272	208	18	561	JAN 15/88
307	NOV 3/87	6 :28	1272	209	8	562	JAN 15/88
307	NOV 3/87	6 :40	1272	209	11	563	JAN 15/88
307	NOV 3/87	7 : 2	1272	209	2	564	JAN 15/88
307	NOV 3/87	7 :13	1272	210	44	565	JAN 15/88
307	NOV 3/87	7 :14	1274	209	7	566	JAN 15/88
307	NOV 3/87	7 :25	1272	209	26	567	JAN 15/88
307	NOV 3/87	7 :36	1272	210	2	568	JAN 15/88
307	NOV 3/87	7 :47	1272	211	11	569	JAN 15/88
307	NOV 3/87	7 :59	1272	212	4	570	JAN 15/88
307	NOV 3/87	8 :10	1272	212	25	571	JAN 15/88
307	NOV 3/87	8 :21	1272	212	16	572	JAN 15/88
307	NOV 3/87	8 :21	1274	212	20	573	JAN 15/88
307	NOV 3/87	8 :32	1272	213	34	574	JAN 15/88
307	NOV 3/87	8 :44	1272	213	7	575	JAN 15/88
307	NOV 3/87	8 :55	1272	213	12	576	JAN 15/88
307	NOV 3/87	9 :17	1272	213	26	577	JAN 15/88
307	NOV 3/87	9 :29	1272	213	27	578	JAN 15/88
307	NOV 3/87	9 :40	1272	213	19	579	JAN 15/88
307	NOV 3/87	9 :51	1272	214	13	580	JAN 15/88
307	NOV 3/87	9 :52	1274	214	56	581	JAN 15/88
307	NOV 3/87	10 : 3	1272	214	7	582	JAN 15/88
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307	NOV 3/87	10 :14	1272	214	26	584	JAN 15/88
307	NOV 3/87	10 :14	1274	215	274	585	JAN 15/88
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307	NOV 3/87	10 :36	1272	214	2	588	JAN 15/88
307	NOV 3/87	10 :37	1274	213	73	589	JAN 15/88
307	NOV 3/87	10 :48	1272	213	6	590	JAN 15/88
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307	NOV 3/87	10 :59	1272	211	14	592	JAN 15/88
307	NOV 3/87	10 :59	1274	211	61	593	JAN 15/88
307	NOV 3/87	11 :10	1272	210	30	594	JAN 15/88
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307	NOV 3/87	11 :21	1272	210	18	596	JAN 15/88
307	NOV 3/87	11 :21	1274	210	47	597	JAN 15/88
307	NOV 3/87	11 :32	1272	204	11	598	JAN 15/88
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307	NOV 3/87	11 :43	1272	204	48	600	JAN 15/88
307	NOV 3/87	11 :44	1274	204	20	601	JAN 15/88
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307	NOV 3/87	11 :55	1274	203	14	603	JAN 15/88
307	NOV 3/87	12 : 6	1272	205	37	604	JAN 15/88
307	NOV 3/87	12 : 6	1274	205	12	605	JAN 15/88
307	NOV 3/87	12 :17	1272	205	0	606	JAN 15/88

307	NOV 3/87	12 :17	1274	205	5	607	JAN 15/88
307	NOV 3/87	12 :41	1272	206	24	608	JAN 15/88
307	NOV 3/87	12 :41	1274	206	121	609	JAN 15/88
307	NOV 3/87	12 :55	1272	206	20	610	JAN 15/88
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307	NOV 3/87	13 :24	1272	209	8	612	JAN 15/88
307	NOV 3/87	13 :39	1274	211	24	613	JAN 15/88
307	NOV 3/87	13 :53	1272	213	29	614	JAN 15/88
307	NOV 3/87	13 :53	1274	212	49	615	JAN 15/88
307	NOV 3/87	14 : 7	1272	214	38	616	JAN 15/88
307	NOV 3/87	14 :22	1272	214	44	617	JAN 15/88
307	NOV 3/87	14 :22	1274	213	32	618	JAN 15/88
307	NOV 3/87	14 :36	1272	215	45	619	JAN 15/88
307	NOV 3/87	14 :36	1274	215	20	620	JAN 15/88
307	NOV 3/87	14 :51	1272	218	27	621	JAN 15/88
307	NOV 3/87	14 :51	1274	218	11	622	JAN 15/88
307	NOV 3/87	15 : 5	1272	220	36	623	JAN 15/88
307	NOV 3/87	15 : 5	1274	221	36	624	JAN 15/88
307	NOV 3/87	15 :19	1272	222	100	625	JAN 15/88
307	NOV 3/87	15 :19	1274	222	12	626	JAN 15/88
307	NOV 3/87	15 :34	1274	223	2	627	JAN 15/88
307	NOV 3/87	15 :48	1272	224	14	628	JAN 15/88
307	NOV 3/87	15 :48	1274	223	45	629	JAN 15/88
307	NOV 3/87	16 : 2	1272	225	95	630	JAN 15/88
307	NOV 3/87	16 : 3	1274	224	13	631	JAN 15/88
307	NOV 3/87	16 :17	1274	225	31	632	JAN 15/88
307	NOV 3/87	16 :31	1272	225	20	633	JAN 15/88
307	NOV 3/87	16 :31	1274	225	11	634	JAN 15/88
307	NOV 3/87	16 :46	1272	226	64	635	JAN 15/88
307	NOV 3/87	16 :46	1274	225	38	636	JAN 15/88
307	NOV 3/87	17 : 0	1272	227	18	637	JAN 15/88
307	NOV 3/87	17 : 0	1274	226	26	638	JAN 15/88
307	NOV 3/87	17 :14	1272	227	30	639	JAN 15/88
307	NOV 3/87	17 :14	1274	227	39	640	JAN 15/88
307	NOV 3/87	17 :29	1272	226	7	641	JAN 15/88
307	NOV 3/87	17 :29	1274	226	12	642	JAN 15/88
307	NOV 3/87	17 :43	1272	227	60	643	JAN 15/88
307	NOV 3/87	17 :57	1272	227	24	644	JAN 15/88
307	NOV 3/87	17 :58	1274	227	91	645	JAN 15/88
307	NOV 3/87	18 :12	1272	227	81	646	JAN 15/88
307	NOV 3/87	18 :12	1274	227	83	647	JAN 15/88
307	NOV 3/87	18 :26	1272	227	57	648	JAN 15/88
307	NOV 3/87	18 :26	1274	227	164	649	JAN 15/88
307	NOV 3/87	18 :41	1272	226	3	650	JAN 15/88
307	NOV 3/87	18 :41	1274	226	9	651	JAN 15/88
307	NOV 3/87	18 :55	1272	226	15	652	JAN 15/88
307	NOV 3/87	19 :10	1274	227	90	653	JAN 15/88
307	NOV 3/87	19 :24	1272	225	24	654	JAN 15/88
307	NOV 3/87	19 :38	1272	225	8	655	JAN 15/88
307	NOV 3/87	19 :38	1274	225	58	656	JAN 15/88
307	NOV 3/87	19 :53	1272	223	4	657	JAN 15/88
307	NOV 3/87	20 : 7	1272	222	20	658	JAN 15/88
307	NOV 3/87	20 :22	1272	222	6	659	JAN 15/88
307	NOV 3/87	20 :22	1274	221	201	660	JAN 15/88
307	NOV 3/87	20 :50	1272	220	23	661	JAN 15/88
307	NOV 3/87	21 : 5	1272	219	6	662	JAN 15/88

307	NOV 3/87	21 : 5	1274	219	105	663	JAN 15/88
307	NOV 3/87	21 :19	1272	218	19	664	JAN 15/88
307	NOV 3/87	21 :19	1274	218	123	665	JAN 15/88
307	NOV 3/87	21 :34	1272	219	23	666	JAN 15/88
307	NOV 3/87	21 :34	1274	218	20	667	JAN 15/88
307	NOV 3/87	21 :48	1272	218	19	668	JAN 15/88
307	NOV 3/87	22 : 3	1272	217	15	669	JAN 15/88
307	NOV 3/87	22 : 3	1274	217	60	670	JAN 15/88
307	NOV 3/87	22 :17	1272	217	20	671	JAN 15/88
307	NOV 3/87	22 :17	1274	217	13	672	JAN 15/88
307	NOV 3/87	22 :31	1272	218	14	673	JAN 15/88
307	NOV 3/87	22 :31	1274	218	92	674	JAN 15/88
307	NOV 3/87	22 :46	1272	218	23	675	JAN 15/88
307	NOV 3/87	22 :46	1274	218	49	676	JAN 15/88
307	NOV 3/87	23 : 0	1272	219	9	677	JAN 15/88
307	NOV 3/87	23 : 0	1274	219	38	678	JAN 15/88
307	NOV 3/87	23 :14	1272	220	18	679	JAN 15/88
307	NOV 3/87	23 :15	1274	220	73	680	JAN 15/88
307	NOV 3/87	23 :29	1272	219	13	681	JAN 15/88
307	NOV 3/87	23 :29	1274	220	35	682	JAN 15/88
307	NOV 3/87	23 :43	1272	219	22	683	JAN 15/88
307	NOV 3/87	23 :43	1274	219	66	684	JAN 15/88
307	NOV 3/87	23 :58	1272	216	122	685	JAN 15/88
307	NOV 3/87	23 :58	1274	217	7	686	JAN 15/88
308	NOV 4/87	0 :12	1272	217	47	687	JAN 15/88
308	NOV 4/87	0 :12	1274	217	80	688	JAN 15/88
308	NOV 4/87	0 :27	1272	219	15	689	JAN 15/88
308	NOV 4/87	0 :27	1274	219	124	690	JAN 15/88
308	NOV 4/87	0 :41	1272	227	4	691	JAN 15/88
308	NOV 4/87	0 :41	1274	226	30	692	JAN 15/88
308	NOV 4/87	0 :56	1274	228	29	693	JAN 15/88
308	NOV 4/87	1 :10	1272	229	28	694	JAN 15/88
308	NOV 4/87	1 :10	1274	230	30	695	JAN 15/88
308	NOV 4/87	1 :24	1272	233	7	696	JAN 15/88
308	NOV 4/87	1 :25	1274	233	21	697	JAN 15/88
308	NOV 4/87	1 :39	1272	231	11	698	JAN 15/88
308	NOV 4/87	1 :39	1274	231	47	699	JAN 15/88
308	NOV 4/87	1 :53	1272	235	15	700	JAN 15/88
308	NOV 4/87	1 :53	1274	235	4	701	JAN 15/88
308	NOV 4/87	2 : 8	1272	234	36	702	JAN 15/88
308	NOV 4/87	2 : 9	1274	234	14	703	JAN 15/88
308	NOV 4/87	2 :22	1272	235	2	704	JAN 15/88
308	NOV 4/87	2 :22	1274	235	283	705	JAN 15/88
308	NOV 4/87	2 :36	1272	231	27	706	JAN 15/88
308	NOV 4/87	2 :37	1274	232	37	707	JAN 15/88
308	NOV 4/87	2 :51	1272	223	6	708	JAN 15/88
308	NOV 4/87	3 : 5	1274	216	36	709	JAN 15/88
308	NOV 4/87	3 :19	1272	219	29	710	JAN 15/88
308	NOV 4/87	3 :20	1274	218	95	711	JAN 15/88
308	NOV 4/87	3 :34	1272	215	3	712	JAN 15/88
308	NOV 4/87	3 :34	1274	215	86	713	JAN 15/88
308	NOV 4/87	3 :48	1272	210	29	714	JAN 15/88
308	NOV 4/87	3 :48	1274	210	45	715	JAN 15/88
308	NOV 4/87	4 : 3	1272	212	24	716	JAN 15/88
308	NOV 4/87	4 : 3	1274	212	35	717	JAN 15/88
308	NOV 4/87	4 :17	1272	215	13	718	JAN 15/88

308	NOV 4/87	4 :17	1274	216	27	719	JAN 15/88
308	NOV 4/87	4 :32	1272	203	9	720	JAN 15/88
308	NOV 4/87	4 :32	1274	204	4	721	JAN 15/88
308	NOV 4/87	4 :46	1272	214	33	722	JAN 15/88
308	NOV 4/87	4 :46	1274	215	31	723	JAN 15/88
308	NOV 4/87	5 : 0	1272	204	6	724	JAN 15/88
308	NOV 4/87	5 : 0	1274	205	121	725	JAN 15/88
308	NOV 4/87	5 :15	1272	227	7	726	JAN 15/88
308	NOV 4/87	5 :15	1274	227	168	727	JAN 15/88
308	NOV 4/87	5 :29	1272	221	49	728	JAN 15/88
308	NOV 4/87	5 :44	1272	208	19	729	JAN 15/88
308	NOV 4/87	5 :58	1272	218	15	730	JAN 15/88
308	NOV 4/87	5 :58	1274	217	125	731	JAN 15/88
308	NOV 4/87	6 :12	1272	223	11	732	JAN 15/88
308	NOV 4/87	6 :13	1274	223	173	733	JAN 15/88
308	NOV 4/87	6 :27	1272	225	57	734	JAN 15/88
308	NOV 4/87	6 :27	1274	225	242	735	JAN 15/88
308	NOV 4/87	6 :41	1272	223	7	736	JAN 15/88
308	NOV 4/87	6 :41	1274	223	23	737	JAN 15/88
308	NOV 4/87	6 :56	1272	224	22	738	JAN 15/88
308	NOV 4/87	7 :10	1272	223	23	739	JAN 15/88
308	NOV 4/87	7 :10	1274	223	286	740	JAN 15/88
308	NOV 4/87	7 :24	1272	222	9	741	JAN 15/88
308	NOV 4/87	7 :25	1274	222	48	742	JAN 15/88
308	NOV 4/87	7 :39	1272	223	25	743	JAN 15/88
308	NOV 4/87	7 :39	1274	223	172	744	JAN 15/88
308	NOV 4/87	7 :53	1272	225	6	745	JAN 15/88
308	NOV 4/87	7 :53	1274	224	85	746	JAN 15/88
308	NOV 4/87	8 : 8	1272	225	6	747	JAN 15/88
308	NOV 4/87	8 : 8	1274	225	20	748	JAN 15/88
308	NOV 4/87	8 :22	1272	225	15	749	JAN 15/88
308	NOV 4/87	8 :22	1274	225	26	750	JAN 15/88
308	NOV 4/87	8 :37	1272	224	4	751	JAN 15/88
308	NOV 4/87	8 :37	1274	223	39	752	JAN 15/88
308	NOV 4/87	8 :51	1272	224	35	753	JAN 15/88
308	NOV 4/87	8 :51	1274	224	27	754	JAN 15/88
308	NOV 4/87	9 : 5	1272	225	27	755	JAN 15/88
308	NOV 4/87	9 :20	1272	229	39	756	JAN 15/88
308	NOV 4/87	9 :20	1274	229	19	757	JAN 15/88
308	NOV 4/87	9 :34	1272	231	38	758	JAN 15/88
308	NOV 4/87	9 :34	1274	231	24	759	JAN 15/88
308	NOV 4/87	9 :49	1272	214	16	760	JAN 15/88
308	NOV 4/87	9 :49	1274	214	9	761	JAN 15/88
308	NOV 4/87	10 : 3	1272	230	12	762	JAN 15/88
308	NOV 4/87	10 : 3	1274	231	13	763	JAN 15/88
308	NOV 4/87	10 :17	1272	231	35	764	JAN 15/88
308	NOV 4/87	10 :18	1274	232	2	765	JAN 15/88
308	NOV 4/87	10 :32	1272	231	73	766	JAN 15/88
308	NOV 4/87	10 :32	1274	232	38	767	JAN 15/88
308	NOV 4/87	10 :46	1272	233	14	768	JAN 15/88
308	NOV 4/87	10 :46	1274	234	42	769	JAN 15/88
308	NOV 4/87	11 : 1	1272	230	15	770	JAN 15/88
308	NOV 4/87	11 : 1	1274	229	15	771	JAN 15/88
308	NOV 4/87	11 :15	1272	240	30	772	JAN 15/88
308	NOV 4/87	11 :15	1274	240	21	773	JAN 15/88
308	NOV 4/87	11 :29	1272	231	19	774	JAN 15/88

308	NOV 4/87	11 :29	1274	231	29	775	JAN 15/88
308	NOV 4/87	11 :44	1274	234	10	776	JAN 15/88
308	NOV 4/87	12 : 3	1272	229	15	777	JAN 15/88
308	NOV 4/87	12 : 3	1274	229	12	778	JAN 15/88
308	NOV 4/87	12 :19	1272	226	54	779	JAN 15/88
308	NOV 4/87	12 :19	1274	226	2	780	JAN 15/88
308	NOV 4/87	12 :34	1274	229	21	781	JAN 15/88
308	NOV 4/87	12 :50	1272	229	24	782	JAN 15/88
308	NOV 4/87	12 :50	1274	228	29	783	JAN 15/88
308	NOV 4/87	13 : 5	1272	227	45	784	JAN 15/88
308	NOV 4/87	13 : 5	1274	227	11	785	JAN 15/88
308	NOV 4/87	13 : 9	1412	225	109	786	JAN 15/88
308	NOV 4/87	13 :20	1272	228	9	787	JAN 15/88
308	NOV 4/87	13 :20	1274	227	21	788	JAN 15/88
308	NOV 4/87	13 :24	1414	225	120	789	JAN 15/88
308	NOV 4/87	13 :35	1272	226	22	790	JAN 15/88
308	NOV 4/87	13 :35	1274	226	26	791	JAN 15/88
308	NOV 4/87	13 :50	1274	225	9	792	JAN 15/88
308	NOV 4/87	14 : 5	1272	226	6	793	JAN 15/88
308	NOV 4/87	14 : 6	1274	226	12	794	JAN 15/88
308	NOV 4/87	14 :21	1272	226	68	795	JAN 15/88
308	NOV 4/87	14 :21	1274	226	34	796	JAN 15/88
308	NOV 4/87	14 :36	1272	226	8	797	JAN 15/88
308	NOV 4/87	14 :36	1274	226	5	798	JAN 15/88
308	NOV 4/87	14 :51	1272	226	28	799	JAN 15/88
308	NOV 4/87	14 :51	1274	226	29	800	JAN 15/88
308	NOV 4/87	15 :21	1272	222	38	801	JAN 15/88
308	NOV 4/87	15 :21	1274	222	29	802	JAN 15/88
308	NOV 4/87	15 :36	1272	221	29	803	JAN 15/88
308	NOV 4/87	15 :36	1274	222	11	804	JAN 15/88
308	NOV 4/87	15 :40	1412	221	105	805	JAN 15/88
308	NOV 4/87	15 :40	1414	221	33	806	JAN 15/88
308	NOV 4/87	15 :51	1274	220	34	807	JAN 15/88
308	NOV 4/87	15 :55	1414	219	32	808	JAN 15/88
308	NOV 4/87	16 : 6	1272	219	93	809	JAN 15/88
308	NOV 4/87	16 : 6	1274	219	11	810	JAN 15/88
308	NOV 4/87	16 :21	1272	221	14	811	JAN 15/88
308	NOV 4/87	16 :22	1274	220	15	812	JAN 15/88
308	NOV 4/87	16 :25	1414	225	32	813	JAN 15/88
308	NOV 4/87	16 :36	1272	226	49	814	JAN 15/88
308	NOV 4/87	16 :36	1274	225	24	815	JAN 15/88
308	NOV 4/87	16 :40	1412	230	41	816	JAN 15/88
308	NOV 4/87	16 :40	1414	229	7	817	JAN 15/88
308	NOV 4/87	16 :55	1412	237	23	818	JAN 15/88
308	NOV 4/87	16 :55	1414	237	9	819	JAN 15/88
308	NOV 4/87	17 : 6	1274	235	145	820	JAN 15/88
308	NOV 4/87	17 :10	1412	239	16	821	JAN 15/88
308	NOV 4/87	17 :10	1414	239	52	822	JAN 15/88
308	NOV 4/87	17 :57	1414	232	109	823	JAN 15/88
308	NOV 4/87	18 :12	1412	231	29	824	JAN 15/88
308	NOV 4/87	18 :12	1414	230	58	825	JAN 15/88
308	NOV 4/87	18 :58	1414	222	149	826	JAN 15/88
308	NOV 4/87	19 : 9	1274	221	130	827	JAN 15/88
308	NOV 4/87	19 :24	1274	219	15	828	JAN 15/88
308	NOV 4/87	19 :28	1414	221	154	829	JAN 15/88
308	NOV 4/87	19 :39	1272	221	47	830	JAN 15/88

308	NOV 4/87	19 :43	1412	221	16	831	JAN 15/88
308	NOV 4/87	19 :43	1414	221	22	832	JAN 15/88
308	NOV 4/87	19 :54	1272	221	23	833	JAN 15/88
308	NOV 4/87	19 :54	1274	220	6	834	JAN 15/88
308	NOV 4/87	19 :58	1414	220	5	835	JAN 15/88
308	NOV 4/87	20 : 9	1272	219	59	836	JAN 15/88
308	NOV 4/87	20 : 9	1274	219	20	837	JAN 15/88
308	NOV 4/87	20 :13	1414	220	28	838	JAN 15/88
308	NOV 4/87	20 :24	1272	220	26	839	JAN 15/88
308	NOV 4/87	20 :24	1274	219	15	840	JAN 15/88
308	NOV 4/87	20 :27	1412	220	29	841	JAN 15/88
308	NOV 4/87	20 :28	1414	220	9	842	JAN 15/88
308	NOV 4/87	20 :39	1274	219	17	843	JAN 15/88
308	NOV 4/87	20 :42	1412	216	4170	844	JAN 15/88
308	NOV 4/87	20 :43	1414	219	49	845	JAN 15/88
308	NOV 4/87	20 :53	1272	217	17	846	JAN 15/88
308	NOV 4/87	20 :54	1274	217	80	847	JAN 15/88
308	NOV 4/87	20 :57	1412	218	26	848	JAN 15/88
308	NOV 4/87	20 :57	1414	218	22	849	JAN 15/88
308	NOV 4/87	21 : 9	1274	215	194	850	JAN 15/88
308	NOV 4/87	21 :28	1412	217	86	851	JAN 15/88
308	NOV 4/87	21 :39	1272	215	11	852	JAN 15/88
308	NOV 4/87	21 :39	1274	215	14	853	JAN 15/88
308	NOV 4/87	21 :43	1412	216	15	854	JAN 15/88
308	NOV 4/87	21 :54	1274	214	42	855	JAN 15/88
308	NOV 4/87	21 :58	1412	216	42	856	JAN 15/88
308	NOV 4/87	21 :58	1414	216	92	857	JAN 15/88
308	NOV 4/87	22 : 9	1272	214	46	858	JAN 15/88
308	NOV 4/87	22 : 9	1274	213	59	859	JAN 15/88
308	NOV 4/87	22 :13	1412	213	15	860	JAN 15/88
308	NOV 4/87	22 :13	1414	214	19	861	JAN 15/88
308	NOV 4/87	22 :24	1272	213	17	862	JAN 15/88
308	NOV 4/87	22 :24	1274	213	43	863	JAN 15/88
308	NOV 4/87	22 :28	1412	215	18	864	JAN 15/88
308	NOV 4/87	22 :28	1414	216	85	865	JAN 15/88
308	NOV 4/87	22 :39	1272	213	9	866	JAN 15/88
308	NOV 4/87	22 :39	1274	213	15	867	JAN 15/88
308	NOV 4/87	22 :43	1412	216	69	868	JAN 15/88
308	NOV 4/87	22 :43	1414	216	28	869	JAN 15/88
308	NOV 4/87	22 :54	1272	214	33	870	JAN 15/88
308	NOV 4/87	22 :54	1274	215	24	871	JAN 15/88
308	NOV 4/87	22 :58	1412	218	32	872	JAN 15/88
308	NOV 4/87	22 :58	1414	217	56	873	JAN 15/88
308	NOV 4/87	23 : 9	1274	215	15	874	JAN 15/88
308	NOV 4/87	23 :13	1412	214	91	875	JAN 15/88
308	NOV 4/87	23 :13	1414	213	30	876	JAN 15/88
308	NOV 4/87	23 :24	1274	216	35	877	JAN 15/88
308	NOV 4/87	23 :27	1412	214	51	878	JAN 15/88
308	NOV 4/87	23 :28	1414	214	28	879	JAN 15/88
308	NOV 4/87	23 :39	1272	220	2	880	JAN 15/88
308	NOV 4/87	23 :39	1274	219	21	881	JAN 15/88
308	NOV 4/87	23 :42	1412	215	12	882	JAN 15/88
308	NOV 4/87	23 :43	1414	215	32	883	JAN 15/88
308	NOV 4/87	23 :54	1272	223	49	884	JAN 15/88
308	NOV 4/87	23 :54	1274	223	2	885	JAN 15/88
308	NOV 4/87	23 :57	1412	217	45	886	JAN 15/88

308	NOV 4/87	23 :57	1414	217	64	887	JAN 15/88
309	NOV 5/87	0 : 8	1272	222	18	888	JAN 15/88
309	NOV 5/87	0 : 9	1274	222	24	889	JAN 15/88
309	NOV 5/87	0 :12	1412	221	23	890	JAN 15/88
309	NOV 5/87	0 :12	1414	221	31	891	JAN 15/88
309	NOV 5/87	0 :13	1416	221	17	892	JAN 15/88
309	NOV 5/87	0 :23	1272	222	38	893	JAN 15/88
309	NOV 5/87	0 :24	1274	221	3	894	JAN 15/88
309	NOV 5/87	0 :27	1412	221	8	895	JAN 15/88
309	NOV 5/87	0 :27	1414	221	111	896	JAN 15/88
309	NOV 5/87	0 :42	1412	218	33	897	JAN 15/88
309	NOV 5/87	0 :42	1414	218	45	898	JAN 15/88
309	NOV 5/87	0 :53	1272	222	7	899	JAN 15/88
309	NOV 5/87	0 :53	1274	222	6	900	JAN 15/88
309	NOV 5/87	0 :57	1412	221	15	901	JAN 15/88
309	NOV 5/87	1 : 8	1272	229	6	902	JAN 15/88
309	NOV 5/87	1 :12	1412	225	34	903	JAN 15/88
309	NOV 5/87	1 :23	1272	232	11	904	JAN 15/88
309	NOV 5/87	1 :27	1412	224	10	905	JAN 15/88
309	NOV 5/87	1 :38	1272	231	14	906	JAN 15/88
309	NOV 5/87	1 :42	1412	226	8	907	JAN 15/88
309	NOV 5/87	1 :54	1272	228	9	908	JAN 15/88
309	NOV 5/87	1 :57	1412	227	43	909	JAN 15/88
309	NOV 5/87	2 : 9	1272	224	6	910	JAN 15/88
309	NOV 5/87	2 :13	1412	226	42	911	JAN 15/88
309	NOV 5/87	2 :24	1272	223	6	912	JAN 15/88
309	NOV 5/87	2 :28	1412	224	41	913	JAN 15/88
309	NOV 5/87	2 :39	1272	224	17	914	JAN 15/88
309	NOV 5/87	2 :39	1274	224	3	915	JAN 15/88
309	NOV 5/87	2 :43	1412	221	22	916	JAN 15/88
309	NOV 5/87	2 :54	1272	225	21	917	JAN 15/88
309	NOV 5/87	2 :58	1412	225	48	918	JAN 15/88
309	NOV 5/87	3 : 9	1272	223	41	919	JAN 15/88
309	NOV 5/87	3 :13	1412	222	105	920	JAN 15/88
309	NOV 5/87	3 :25	1272	223	23	921	JAN 15/88
309	NOV 5/87	3 :28	1412	220	49	922	JAN 15/88
309	NOV 5/87	3 :40	1272	225	2	923	JAN 15/88
309	NOV 5/87	3 :44	1412	221	23	924	JAN 15/88
309	NOV 5/87	3 :55	1272	226	30	925	JAN 15/88
309	NOV 5/87	3 :59	1412	223	32	926	JAN 15/88
309	NOV 5/87	4 :10	1272	225	6	927	JAN 15/88
309	NOV 5/87	4 :14	1412	227	9	928	JAN 15/88
309	NOV 5/87	4 :25	1272	226	20	929	JAN 15/88
309	NOV 5/87	4 :29	1412	226	33	930	JAN 15/88
309	NOV 5/87	4 :41	1272	223	30	931	JAN 15/88
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309	NOV 5/87	4 :56	1272	221	9	933	JAN 15/88
309	NOV 5/87	5 : 0	1412	222	87	934	JAN 15/88
309	NOV 5/87	5 :12	1272	222	29	935	JAN 15/88
309	NOV 5/87	5 :16	1412	225	31	936	JAN 15/88
309	NOV 5/87	5 :27	1272	222	21	937	JAN 15/88
309	NOV 5/87	5 :31	1412	229	34	938	JAN 15/88
309	NOV 5/87	5 :42	1272	226	19	939	JAN 15/88
309	NOV 5/87	5 :46	1412	231	42	940	JAN 15/88
309	NOV 5/87	5 :58	1272	225	26	941	JAN 15/88
309	NOV 5/87	6 : 2	1412	227	22	942	JAN 15/88

309	NOV 5/87	6 :29	1272	223	79	943	JAN 15/88
309	NOV 5/87	6 :33	1412	225	33	944	JAN 15/88
309	NOV 5/87	6 :44	1272	223	23	945	JAN 15/88
309	NOV 5/87	6 :59	1272	223	23	946	JAN 15/88
309	NOV 5/87	7 : 3	1412	227	176	947	JAN 15/88
309	NOV 5/87	7 :15	1272	223	48	948	JAN 15/88
309	NOV 5/87	7 :34	1412	225	163	949	JAN 15/88
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309	NOV 5/87	8 : 1	1272	222	42	951	JAN 15/88
309	NOV 5/87	8 : 5	1412	225	42	952	JAN 15/88
309	NOV 5/87	8 :16	1272	223	57	953	JAN 15/88
309	NOV 5/87	8 :31	1272	221	46	954	JAN 15/88
309	NOV 5/87	8 :47	1272	223	32	955	JAN 15/88
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309	NOV 5/87	9 : 6	1412	226	58	957	JAN 15/88
309	NOV 5/87	9 :17	1272	226	26	958	JAN 15/88
309	NOV 5/87	9 :21	1412	227	40	959	JAN 15/88
309	NOV 5/87	9 :37	1412	226	12	960	JAN 15/88
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309	NOV 5/87	14 :55	1272	235	6	988	JAN 15/88
309	NOV 5/87	14 :59	1412	226	94	989	JAN 15/88
309	NOV 5/87	15 :14	1412	234	77	990	JAN 15/88
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309	NOV 5/87	15 :45	1412	233	64	993	JAN 15/88
309	NOV 5/87	16 : 1	1412	235	65	994	JAN 15/88
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309	NOV 5/87	16 :43	1272	229	96	996	JAN 15/88
309	NOV 5/87	16 :46	1412	234	106	997	JAN 15/88
309	NOV 5/87	16 :58	1272	229	13	998	JAN 15/88

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311	NOV 7/87	12 :13	1272	183	72	1000	JAN 15/88
311	NOV 7/87	12 :28	1272	183	97	1001	JAN 15/88
311	NOV 7/87	12 :32	1412	191	23	1002	JAN 15/88
311	NOV 7/87	12 :43	1272	183	8	1003	JAN 15/88
311	NOV 7/87	12 :48	1412	191	27	1004	JAN 15/88
311	NOV 7/87	12 :59	1272	184	38	1005	JAN 15/88
311	NOV 7/87	13 : 3	1412	191	62	1006	JAN 15/88
311	NOV 7/87	13 :14	1272	184	46	1007	JAN 15/88
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311	NOV 7/87	13 :34	1412	192	64	1010	JAN 15/88
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311	NOV 7/87	15 :21	1412	195	29	1022	JAN 15/88
311	NOV 7/87	15 :33	1272	190	20	1023	JAN 15/88
311	NOV 7/87	15 :48	1272	190	91	1024	JAN 15/88
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312	NOV 8/87	5 :33	1272	175	203	1026	JAN 15/88
312	NOV 8/87	5 :48	1272	176	33	1027	JAN 15/88
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312	NOV 8/87	6 :19	1272	173	36	1029	JAN 15/88
312	NOV 8/87	6 :35	1272	181	17	1030	JAN 15/88
312	NOV 8/87	6 :50	1272	196	195	1031	JAN 15/88
312	NOV 8/87	6 :54	1412	179	160	1032	JAN 15/88
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312	NOV 8/87	7 :21	1272	211	138	1034	JAN 15/88
312	NOV 8/87	7 :36	1272	215	96	1035	JAN 15/88
312	NOV 8/87	7 :52	1272	214	245	1036	JAN 15/88
312	NOV 8/87	7 :56	1412	215	120	1037	JAN 15/88
312	NOV 8/87	8 : 7	1272	211	46	1038	JAN 15/88
312	NOV 8/87	8 :11	1412	203	218	1039	JAN 15/88
312	NOV 8/87	8 :23	1272	211	78	1040	JAN 15/88
312	NOV 8/87	8 :38	1272	209	20	1041	JAN 15/88
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312	NOV 8/87	8 :53	1272	208	48	1043	JAN 15/88
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312	NOV 8/87	9 :55	1272	202	119	1051	JAN 15/88
312	NOV 8/87	9 :59	1412	204	103	1052	JAN 15/88
312	NOV 8/87	10 :11	1272	200	68	1053	JAN 15/88
312	NOV 8/87	10 :15	1412	203	80	1054	JAN 15/88

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312	NOV 8/87	10 :30	1412	200	44	1056	JAN 15/88
312	NOV 8/87	10 :41	1272	199	33	1057	JAN 15/88
312	NOV 8/87	10 :45	1412	204	68	1058	JAN 15/88
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312	NOV 8/87	11 :28	1272	200	61	1063	JAN 15/88
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312	NOV 8/87	11 :58	1272	202	45	1067	JAN 15/88
312	NOV 8/87	12 :14	1272	201	24	1068	JAN 15/88
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312	NOV 8/87	12 :44	1272	202	171	1071	JAN 15/88
312	NOV 8/87	12 :48	1412	206	10	1072	JAN 15/88
312	NOV 8/87	13 : 4	1412	206	71	1073	JAN 15/88
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312	NOV 8/87	14 :17	1272	190	7	1080	JAN 15/88
312	NOV 8/87	14 :21	1412	194	41	1081	JAN 15/88
312	NOV 8/87	14 :32	1272	189	50	1082	JAN 15/88
312	NOV 8/87	14 :36	1412	194	46	1083	JAN 15/88
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312	NOV 8/87	15 : 3	1272	187	5	1086	JAN 15/88
312	NOV 8/87	15 : 7	1412	193	33	1087	JAN 15/88
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312	NOV 8/87	16 :54	1412	195	34	1101	JAN 15/88
312	NOV 8/87	17 : 6	1272	189	26	1102	JAN 15/88
312	NOV 8/87	17 :10	1412	195	3	1103	JAN 15/88
312	NOV 8/87	17 :21	1272	189	16	1104	JAN 15/88
312	NOV 8/87	17 :25	1412	194	34	1105	JAN 15/88
312	NOV 8/87	17 :36	1272	187	35	1106	JAN 15/88
312	NOV 8/87	17 :40	1412	194	34	1107	JAN 15/88
312	NOV 8/87	17 :52	1272	186	33	1108	JAN 15/88
312	NOV 8/87	17 :56	1412	192	34	1109	JAN 15/88
312	NOV 8/87	18 : 7	1272	186	25	1110	JAN 15/88

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312	NOV 8/87	18 :22	1272	185	9	1112	JAN 15/88
312	NOV 8/87	18 :26	1412	193	15	1113	JAN 15/88
312	NOV 8/87	18 :38	1272	186	6	1114	JAN 15/88
312	NOV 8/87	18 :42	1412	190	5	1115	JAN 15/88
312	NOV 8/87	18 :57	1412	191	23	1116	JAN 15/88
312	NOV 8/87	19 : 8	1272	185	15	1117	JAN 15/88
312	NOV 8/87	19 :12	1412	192	62	1118	JAN 15/88
312	NOV 8/87	19 :24	1272	188	7	1119	JAN 15/88
312	NOV 8/87	19 :28	1412	195	11	1120	JAN 15/88
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312	NOV 8/87	19 :43	1412	194	46	1122	JAN 15/88
312	NOV 8/87	19 :54	1272	189	40	1123	JAN 15/88
312	NOV 8/87	19 :58	1412	195	13	1124	JAN 15/88
312	NOV 8/87	20 :10	1272	189	26	1125	JAN 15/88
312	NOV 8/87	20 :14	1412	196	14	1126	JAN 15/88
312	NOV 8/87	20 :25	1272	189	15	1127	JAN 15/88
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312	NOV 8/87	20 :56	1272	191	20	1131	JAN 15/88
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312	NOV 8/87	21 :11	1272	191	6	1133	JAN 15/88
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312	NOV 8/87	21 :26	1272	191	4	1135	JAN 15/88
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312	NOV 8/87	21 :42	1272	190	36	1137	JAN 15/88
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312	NOV 8/87	22 :28	1272	192	38	1143	JAN 15/88
312	NOV 8/87	22 :31	1412	199	47	1144	JAN 15/88
312	NOV 8/87	22 :43	1272	190	15	1145	JAN 15/88
312	NOV 8/87	22 :47	1412	197	8	1146	JAN 15/88
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312	NOV 8/87	23 :14	1272	191	47	1149	JAN 15/88
312	NOV 8/87	23 :18	1412	195	45	1150	JAN 15/88
312	NOV 8/87	23 :29	1272	191	33	1151	JAN 15/88
312	NOV 8/87	23 :33	1412	199	104	1152	JAN 15/88
312	NOV 8/87	23 :44	1272	190	23	1153	JAN 15/88
312	NOV 8/87	23 :48	1412	197	76	1154	JAN 15/88
313	NOV 9/87	0 : 0	1272	191	20	1155	JAN 15/88
313	NOV 9/87	0 : 4	1412	197	56	1156	JAN 15/88
313	NOV 9/87	0 :15	1272	190	6	1157	JAN 15/88
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313	NOV 9/87	0 :30	1272	189	47	1159	JAN 15/88
313	NOV 9/87	0 :34	1412	197	49	1160	JAN 15/88
313	NOV 9/87	0 :45	1272	189	6	1161	JAN 15/88
313	NOV 9/87	0 :49	1412	195	8	1162	JAN 15/88
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313	NOV 9/87	1 : 5	1412	197	62	1164	JAN 15/88
313	NOV 9/87	1 :16	1272	189	2	1165	JAN 15/88
313	NOV 9/87	1 :20	1412	197	58	1166	JAN 15/88

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313	NOV 9/87	1 :35	1412	196	16	1168	JAN 15/88
313	NOV 9/87	1 :47	1272	189	2	1169	JAN 15/88
313	NOV 9/87	1 :51	1412	195	48	1170	JAN 15/88
313	NOV 9/87	2 : 2	1272	186	11	1171	JAN 15/88
313	NOV 9/87	2 : 6	1412	194	76	1172	JAN 15/88
313	NOV 9/87	2 :18	1272	185	15	1173	JAN 15/88
313	NOV 9/87	2 :22	1412	194	26	1174	JAN 15/88
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313	NOV 9/87	2 :37	1412	193	47	1176	JAN 15/88
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313	NOV 9/87	2 :52	1412	195	34	1178	JAN 15/88
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313	NOV 9/87	3 :19	1272	188	86	1180	JAN 15/88
313	NOV 9/87	3 :23	1412	194	375	1181	JAN 15/88
313	NOV 9/87	3 :35	1272	186	130	1182	JAN 15/88
313	NOV 9/87	3 :39	1412	194	37	1183	JAN 15/88
313	NOV 9/87	3 :50	1272	186	114	1184	JAN 15/88
313	NOV 9/87	4 : 5	1272	187	102	1185	JAN 15/88
313	NOV 9/87	4 :21	1272	188	51	1186	JAN 15/88
313	NOV 9/87	9 :22	1272	188	60	1187	JAN 15/88
313	NOV 9/87	10 :40	1272	190	6	1188	JAN 15/88
313	NOV 9/87	10 :56	1272	189	92	1189	JAN 15/88
313	NOV 9/87	11 : 0	1412	198	204	1190	JAN 15/88
313	NOV 9/87	11 :11	1272	191	38	1191	JAN 15/88
313	NOV 9/87	11 :15	1412	197	18	1192	JAN 15/88
313	NOV 9/87	11 :27	1272	190	56	1193	JAN 15/88
313	NOV 9/87	11 :31	1412	198	59	1194	JAN 15/88
313	NOV 9/87	11 :46	1412	197	42	1195	JAN 15/88
313	NOV 9/87	11 :58	1272	188	35	1196	JAN 15/88
313	NOV 9/87	12 : 2	1412	196	104	1197	JAN 15/88
313	NOV 9/87	12 :13	1272	188	31	1198	JAN 15/88
313	NOV 9/87	12 :17	1412	197	42	1199	JAN 15/88
313	NOV 9/87	12 :29	1272	191	109	1200	JAN 15/88
313	NOV 9/87	12 :33	1412	198	156	1201	JAN 15/88
313	NOV 9/87	13 :16	1272	191	152	1202	JAN 15/88
313	NOV 9/87	13 :47	1272	192	86	1203	JAN 15/88
315	NOV 11/87	13 :34	1272	183	185	1204	JAN 15/88
316	NOV 12/87	12 : 2	1272	190	54	1205	JAN 15/88
316	NOV 12/87	12 :17	1272	191	29	1206	JAN 15/88
316	NOV 12/87	12 :33	1272	191	112	1207	JAN 15/88
316	NOV 12/87	12 :48	1272	188	27	1208	JAN 15/88
316	NOV 12/87	13 : 4	1272	183	71	1209	JAN 15/88
316	NOV 12/87	13 :19	1272	182	17	1210	JAN 15/88
316	NOV 12/87	13 :23	1412	188	33	1211	JAN 15/88
316	NOV 12/87	13 :35	1272	181	18	1212	JAN 15/88
316	NOV 12/87	13 :39	1412	187	48	1213	JAN 15/88
316	NOV 12/87	13 :50	1272	178	15	1214	JAN 15/88
316	NOV 12/87	13 :54	1412	185	246	1215	JAN 15/88
316	NOV 12/87	14 : 6	1272	178	6	1216	JAN 15/88
316	NOV 12/87	14 :10	1412	184	72	1217	JAN 15/88
316	NOV 12/87	14 :21	1272	178	20	1218	JAN 15/88
316	NOV 12/87	14 :25	1412	184	151	1219	JAN 15/88
316	NOV 12/87	14 :36	1272	172	45	1220	JAN 15/88
316	NOV 12/87	14 :40	1412	163	110	1221	JAN 15/88
316	NOV 12/87	14 :52	1272	161	86	1222	JAN 15/88

316	NOV 12/87	14 :56	1412	168	44	1223	JAN 15/88
316	NOV 12/87	15 : 7	1272	159	19	1224	JAN 15/88
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316	NOV 12/87	15 :42	1412	163	77	1229	JAN 15/88
316	NOV 12/87	15 :54	1272	154	6	1230	JAN 15/88
316	NOV 12/87	15 :58	1412	161	11	1231	JAN 15/88
316	NOV 12/87	16 : 9	1272	154	4	1232	JAN 15/88
316	NOV 12/87	16 :13	1412	161	5	1233	JAN 15/88
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316	NOV 12/87	16 :40	1272	152	20	1236	JAN 15/88
316	NOV 12/87	16 :44	1412	158	9	1237	JAN 15/88
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316	NOV 12/87	16 :59	1412	156	23	1239	JAN 15/88
316	NOV 12/87	17 :11	1272	151	14	1240	JAN 15/88
316	NOV 12/87	17 :15	1412	157	94	1241	JAN 15/88
316	NOV 12/87	17 :26	1272	150	31	1242	JAN 15/88
316	NOV 12/87	17 :30	1412	157	122	1243	JAN 15/88
316	NOV 12/87	17 :42	1272	149	29	1244	JAN 15/88
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316	NOV 12/87	18 : 1	1412	156	37	1247	JAN 15/88
316	NOV 12/87	18 :13	1272	150	58	1248	JAN 15/88
316	NOV 12/87	18 :17	1412	156	32	1249	JAN 15/88
316	NOV 12/87	18 :28	1272	149	11	1250	JAN 15/88
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316	NOV 12/87	19 : 3	1412	155	43	1255	JAN 15/88
316	NOV 12/87	19 :14	1272	149	16	1256	JAN 15/88
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316	NOV 12/87	19 :49	1412	155	121	1261	JAN 15/88
316	NOV 12/87	20 : 1	1272	147	8	1262	JAN 15/88
316	NOV 12/87	20 : 5	1412	155	21	1263	JAN 15/88
316	NOV 12/87	20 :16	1272	148	40	1264	JAN 15/88
316	NOV 12/87	20 :20	1412	155	188	1265	JAN 15/88
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316	NOV 12/87	20 :36	1412	154	33	1267	JAN 15/88
316	NOV 12/87	20 :47	1272	146	13	1268	JAN 15/88
316	NOV 12/87	20 :51	1412	154	78	1269	JAN 15/88
316	NOV 12/87	21 : 3	1272	145	10	1270	JAN 15/88
316	NOV 12/87	21 : 6	1412	151	72	1271	JAN 15/88
316	NOV 12/87	21 :18	1272	145	14	1272	JAN 15/88
316	NOV 12/87	21 :22	1412	152	134	1273	JAN 15/88
316	NOV 12/87	21 :34	1272	145	28	1274	JAN 15/88
316	NOV 12/87	21 :49	1272	146	62	1275	JAN 15/88
316	NOV 12/87	22 : 5	1272	146	69	1276	JAN 15/88
316	NOV 12/87	22 :20	1272	146	122	1277	JAN 15/88
317	NOV 13/87	6 :16	1272	133	183	1278	JAN 15/88

317	NOV 13/87	6 :32	1272	140	132	1279	JAN 15/88
317	NOV 13/87	7 : 3	1272	150	102	1280	JAN 15/88
317	NOV 13/87	7 :18	1272	151	38	1281	JAN 15/88
317	NOV 13/87	7 :34	1272	155	56	1282	JAN 15/88
317	NOV 13/87	7 :49	1272	156	44	1283	JAN 15/88
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317	NOV 13/87	8 :21	1272	157	21	1285	JAN 15/88
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317	NOV 13/87	11 :10	1272	165	3	1303	JAN 15/88
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317	NOV 13/87	11 :26	1272	154	53	1305	JAN 15/88
317	NOV 13/87	11 :30	1412	160	15	1306	JAN 15/88
317	NOV 13/87	11 :45	1412	174	16	1307	JAN 15/88
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317	NOV 13/87	12 :46	1412	179	24	1313	JAN 15/88
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317	NOV 13/87	15 : 4	1412	172	24	1327	JAN 15/88
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317	NOV 13/87	15 :46	1272	164	47	1331	JAN 15/88
317	NOV 13/87	15 :50	1412	167	48	1332	JAN 15/88
317	NOV 13/87	16 : 1	1272	161	30	1333	JAN 15/88
317	NOV 13/87	16 :21	1412	160	16	1334	JAN 15/88

317	NOV 13/87	16 :32	1272	162	6	1335	JAN 15/88
317	NOV 13/87	16 :48	1272	160	40	1336	JAN 15/88
317	NOV 13/87	16 :52	1412	169	188	1337	JAN 15/88
317	NOV 13/87	17 : 3	1272	162	25	1338	JAN 15/88
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317	NOV 13/87	18 :20	1272	155	15	1348	JAN 15/88
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317	NOV 13/87	20 :43	1412	161	6	1365	JAN 15/88
317	NOV 13/87	20 :54	1272	154	11	1366	JAN 15/88
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317	NOV 13/87	23 :59	1272	154	22	1388	JAN 15/88
318	NOV 14/87	0 : 3	1412	161	9	1389	JAN 15/88
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318	NOV 14/87	0 :45	1272	153	30	1394	JAN 15/88
318	NOV 14/87	0 :50	1412	162	58	1395	JAN 15/88
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318	NOV 14/87	12 :29	1412	174	2	1450	JAN 15/88
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318	NOV 14/87	15 :33	1414	172	23	1478	JAN 15/88
318	NOV 14/87	15 :44	1272	160	8	1479	JAN 15/88
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318	NOV 14/87	15 :59	1272	162	24	1483	JAN 15/88
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321	NOV 17/87	19 :45	1272	194	11	1757	JAN 15/88
321	NOV 17/87	19 :45	1274	194	74	1758	JAN 15/88
321	NOV 17/87	20 : 0	1272	194	7	1759	JAN 15/88
321	NOV 17/87	20 : 1	1274	193	192	1760	JAN 15/88
321	NOV 17/87	20 :16	1272	196	28	1761	JAN 15/88
321	NOV 17/87	20 :16	1274	195	90	1762	JAN 15/88
321	NOV 17/87	20 :31	1272	195	6	1763	JAN 15/88
321	NOV 17/87	20 :31	1274	195	76	1764	JAN 15/88
321	NOV 17/87	20 :46	1272	197	11	1765	JAN 15/88
321	NOV 17/87	20 :46	1274	196	58	1766	JAN 15/88
321	NOV 17/87	21 : 1	1272	196	11	1767	JAN 15/88
321	NOV 17/87	21 : 1	1274	196	11	1768	JAN 15/88
321	NOV 17/87	21 :16	1272	195	38	1769	JAN 15/88
321	NOV 17/87	21 :17	1274	195	69	1770	JAN 15/88
321	NOV 17/87	21 :20	1412	203	15	1771	JAN 15/88
321	NOV 17/87	21 :20	1414	203	34	1772	JAN 15/88
321	NOV 17/87	21 :31	1272	189	19	1773	JAN 15/88
321	NOV 17/87	21 :32	1274	189	106	1774	JAN 15/88
321	NOV 17/87	21 :35	1412	201	42	1775	JAN 15/88
321	NOV 17/87	21 :46	1272	195	17	1776	JAN 15/88
321	NOV 17/87	21 :47	1274	194	111	1777	JAN 15/88
321	NOV 17/87	22 : 2	1272	194	3	1778	JAN 15/88
321	NOV 17/87	22 : 2	1274	194	8	1779	JAN 15/88
321	NOV 17/87	22 :17	1272	196	7	1780	JAN 15/88
321	NOV 17/87	22 :32	1272	198	3	1781	JAN 15/88
321	NOV 17/87	22 :47	1272	199	11	1782	JAN 15/88

321	NOV 17/87	22 :51	1412	206	38	1783	JAN 15/88
321	NOV 17/87	23 : 3	1272	202	25	1784	JAN 15/88
321	NOV 17/87	23 : 6	1412	208	93	1785	JAN 15/88
321	NOV 17/87	23 :18	1272	202	13	1786	JAN 15/88
321	NOV 17/87	23 :22	1412	209	72	1787	JAN 15/88
321	NOV 17/87	23 :33	1272	203	19	1788	JAN 15/88
321	NOV 17/87	23 :37	1414	208	29	1789	JAN 15/88
321	NOV 17/87	23 :48	1272	203	19	1790	JAN 15/88
322	NOV 18/87	0 : 4	1272	204	7	1791	JAN 15/88
322	NOV 18/87	0 :19	1272	200	96	1792	JAN 15/88
322	NOV 18/87	0 :35	1272	197	56	1793	JAN 15/88
322	NOV 18/87	0 :50	1272	200	13	1794	JAN 15/88
322	NOV 18/87	1 : 6	1272	194	11	1795	JAN 15/88
322	NOV 18/87	1 :22	1272	193	6	1796	JAN 15/88
322	NOV 18/87	1 :37	1272	167	16	1797	JAN 15/88
322	NOV 18/87	1 :53	1272	182	30	1798	JAN 15/88
322	NOV 18/87	2 : 8	1272	156	29	1799	JAN 15/88
322	NOV 18/87	2 :24	1272	174	23	1800	JAN 15/88
322	NOV 18/87	2 :55	1272	184	6	1801	JAN 15/88
322	NOV 18/87	3 :10	1272	185	19	1802	JAN 15/88
322	NOV 18/87	3 :26	1272	185	17	1803	JAN 15/88
322	NOV 18/87	3 :42	1272	181	21	1804	JAN 15/88
322	NOV 18/87	4 :13	1272	190	7	1805	JAN 15/88
322	NOV 18/87	4 :28	1272	189	21	1806	JAN 15/88
322	NOV 18/87	4 :44	1272	187	116	1807	JAN 15/88
322	NOV 18/87	4 :48	1412	195	5	1808	JAN 15/88
322	NOV 18/87	4 :59	1272	190	2	1809	JAN 15/88
322	NOV 18/87	5 :15	1272	190	2	1810	JAN 15/88
322	NOV 18/87	5 :31	1272	192	3	1811	JAN 15/88
322	NOV 18/87	5 :46	1272	196	20	1812	JAN 15/88
322	NOV 18/87	6 : 2	1272	192	14	1813	JAN 15/88
322	NOV 18/87	6 :17	1272	196	47	1814	JAN 15/88
322	NOV 18/87	6 :33	1272	195	19	1815	JAN 15/88
322	NOV 18/87	6 :48	1272	193	56	1816	JAN 15/88
322	NOV 18/87	7 : 3	1272	195	12	1817	JAN 15/88
322	NOV 18/87	7 : 7	1412	203	73	1818	JAN 15/88
322	NOV 18/87	7 :19	1272	186	9	1819	JAN 15/88
322	NOV 18/87	7 :34	1272	190	23	1820	JAN 15/88
322	NOV 18/87	7 :50	1272	198	34	1821	JAN 15/88
322	NOV 18/87	8 : 5	1272	203	9	1822	JAN 15/88
322	NOV 18/87	8 :21	1272	198	24	1823	JAN 15/88
322	NOV 18/87	8 :36	1272	196	38	1824	JAN 15/88
322	NOV 18/87	8 :52	1272	194	3	1825	JAN 15/88
322	NOV 18/87	9 : 7	1272	196	11	1826	JAN 15/88
322	NOV 18/87	9 :23	1272	190	60	1827	JAN 15/88
322	NOV 18/87	9 :39	1272	193	23	1828	JAN 15/88
322	NOV 18/87	9 :54	1272	188	2	1829	JAN 15/88
322	NOV 18/87	10 :10	1272	185	36	1830	JAN 15/88
322	NOV 18/87	10 :25	1272	185	19	1831	JAN 15/88
322	NOV 18/87	10 :41	1272	187	24	1832	JAN 15/88
322	NOV 18/87	10 :56	1272	192	29	1833	JAN 15/88
322	NOV 18/87	11 :12	1272	187	8	1834	JAN 15/88
322	NOV 18/87	11 :28	1272	193	11	1835	JAN 15/88
322	NOV 18/87	11 :43	1272	191	91	1836	JAN 15/88
322	NOV 18/87	11 :59	1272	190	15	1837	JAN 15/88
322	NOV 18/87	12 :14	1272	192	6	1838	JAN 15/88

322	NOV 18/87	12 :30	1272	192	14	1839	JAN 15/88
322	NOV 18/87	12 :46	1272	198	41	1840	JAN 15/88
322	NOV 18/87	13 : 1	1272	198	58	1841	JAN 15/88
322	NOV 18/87	13 :33	1272	199	47	1842	JAN 15/88
322	NOV 18/87	13 :48	1272	194	14	1843	JAN 15/88
322	NOV 18/87	14 :35	1272	209	34	1844	JAN 15/88
322	NOV 18/87	14 :50	1272	203	2	1845	JAN 15/88
322	NOV 18/87	15 : 6	1272	202	8	1846	JAN 15/88
322	NOV 18/87	15 :22	1272	196	22	1847	JAN 15/88
322	NOV 18/87	15 :37	1272	197	86	1848	JAN 15/88
322	NOV 18/87	15 :53	1272	201	27	1849	JAN 15/88
322	NOV 18/87	16 : 9	1272	199	62	1850	JAN 15/88
322	NOV 18/87	16 :24	1272	192	7	1851	JAN 15/88
322	NOV 18/87	16 :40	1272	200	47	1852	JAN 15/88
322	NOV 18/87	16 :56	1272	203	58	1853	JAN 15/88
322	NOV 18/87	17 :11	1272	207	11	1854	JAN 15/88
322	NOV 18/87	17 :27	1272	200	33	1855	JAN 15/88
322	NOV 18/87	17 :42	1272	197	20	1856	JAN 15/88
322	NOV 18/87	17 :58	1272	199	7	1857	JAN 15/88
322	NOV 18/87	18 :14	1272	198	30	1858	JAN 15/88
322	NOV 18/87	18 :29	1272	197	29	1859	JAN 15/88
322	NOV 18/87	18 :45	1272	193	25	1860	JAN 15/88
323	NOV 19/87	10 :19	1272	185	74	1861	JAN 15/88
323	NOV 19/87	10 :34	1272	178	13	1862	JAN 15/88
323	NOV 19/87	10 :50	1272	187	72	1863	JAN 15/88
323	NOV 19/87	11 : 6	1272	190	38	1864	JAN 15/88
323	NOV 19/87	11 :21	1272	198	38	1865	JAN 15/88
323	NOV 19/87	11 :37	1272	194	39	1866	JAN 15/88
323	NOV 19/87	11 :53	1272	192	60	1867	JAN 15/88
323	NOV 19/87	12 : 8	1272	193	37	1868	JAN 15/88
323	NOV 19/87	12 :40	1272	181	29	1869	JAN 15/88
323	NOV 19/87	12 :55	1272	185	28	1870	JAN 15/88
323	NOV 19/87	13 :11	1272	189	11	1871	JAN 15/88
323	NOV 19/87	13 :27	1272	198	13	1872	JAN 15/88
323	NOV 19/87	13 :42	1272	186	11	1873	JAN 15/88
323	NOV 19/87	13 :58	1272	175	822	1874	JAN 15/88
323	NOV 19/87	14 :29	1272	184	44	1875	JAN 15/88
323	NOV 19/87	15 : 1	1272	182	58	1876	JAN 15/88
323	NOV 19/87	15 :16	1272	189	4	1877	JAN 15/88
323	NOV 19/87	15 :32	1272	178	18	1878	JAN 15/88
323	NOV 19/87	15 :48	1272	177	41	1879	JAN 15/88
323	NOV 19/87	16 : 4	1272	172	46	1880	JAN 15/88
323	NOV 19/87	16 :19	1272	190	39	1881	JAN 15/88
323	NOV 19/87	16 :51	1272	186	11	1882	JAN 15/88
323	NOV 19/87	17 : 7	1272	186	33	1883	JAN 15/88
323	NOV 19/87	17 :22	1272	186	11	1884	JAN 15/88
323	NOV 19/87	17 :38	1272	184	6	1885	JAN 15/88
323	NOV 19/87	17 :53	1272	183	33	1886	JAN 15/88
323	NOV 19/87	18 : 9	1272	185	28	1887	JAN 15/88
323	NOV 19/87	18 :25	1272	183	24	1888	JAN 15/88
323	NOV 19/87	18 :40	1272	180	18	1889	JAN 15/88
323	NOV 19/87	18 :56	1272	176	6	1890	JAN 15/88
323	NOV 19/87	19 :12	1272	189	122	1891	JAN 15/88
323	NOV 19/87	19 :27	1272	192	39	1892	JAN 15/88
323	NOV 19/87	19 :43	1272	197	6	1893	JAN 15/88
323	NOV 19/87	19 :59	1272	195	20	1894	JAN 15/88

323	NOV 19/87	20 :14	1272	200	34	1895	JAN 15/88
323	NOV 19/87	20 :46	1272	201	23	1896	JAN 15/88
323	NOV 19/87	21 : 1	1272	195	99	1897	JAN 15/88
323	NOV 19/87	21 :17	1272	197	40	1898	JAN 15/88
323	NOV 19/87	21 :33	1272	198	113	1899	JAN 15/88
323	NOV 19/87	21 :49	1272	200	36	1900	JAN 15/88
323	NOV 19/87	22 : 4	1272	196	29	1901	JAN 15/88
323	NOV 19/87	22 :36	1272	192	71	1902	JAN 15/88
323	NOV 19/87	22 :51	1272	195	99	1903	JAN 15/88
323	NOV 19/87	23 : 7	1272	195	65	1904	JAN 15/88
323	NOV 19/87	23 :23	1272	197	60	1905	JAN 15/88
327	NOV 23/87	9 :42	1272	174	174	1906	JAN 15/88
327	NOV 23/87	9 :57	1272	172	29	1907	JAN 15/88
327	NOV 23/87	10 :13	1272	175	23	1908	JAN 15/88
327	NOV 23/87	10 :29	1272	175	271	1909	JAN 15/88
327	NOV 23/87	11 :32	1272	178	38	1910	JAN 15/88
327	NOV 23/87	11 :48	1272	171	21	1911	JAN 15/88
327	NOV 23/87	12 : 3	1272	159	77	1912	JAN 15/88
327	NOV 23/87	12 :19	1272	178	35	1913	JAN 15/88
327	NOV 23/87	12 :35	1272	177	47	1914	JAN 15/88
327	NOV 23/87	12 :50	1272	179	20	1915	JAN 15/88
327	NOV 23/87	13 : 6	1272	178	131	1916	JAN 15/88
327	NOV 23/87	13 :22	1272	180	88	1917	JAN 15/88
327	NOV 23/87	13 :37	1272	181	66	1918	JAN 15/88
327	NOV 23/87	14 : 9	1272	184	163	1919	JAN 15/88
327	NOV 23/87	14 :24	1272	186	33	1920	JAN 15/88
327	NOV 23/87	14 :40	1272	185	67	1921	JAN 15/88
327	NOV 23/87	14 :56	1272	182	163	1922	JAN 15/88
327	NOV 23/87	15 :12	1272	181	117	1923	JAN 15/88
327	NOV 23/87	15 :27	1272	180	64	1924	JAN 15/88
327	NOV 23/87	15 :43	1272	180	89	1925	JAN 15/88
327	NOV 23/87	15 :59	1272	180	14	1926	JAN 15/88
327	NOV 23/87	16 :14	1272	179	13	1927	JAN 15/88
327	NOV 23/87	16 :30	1272	177	73	1928	JAN 15/88
327	NOV 23/87	16 :46	1272	176	109	1929	JAN 15/88
327	NOV 23/87	17 : 1	1272	178	251	1930	JAN 15/88
327	NOV 23/87	18 : 4	1272	182	104	1931	JAN 15/88
327	NOV 23/87	18 :20	1272	184	9	1932	JAN 15/88
327	NOV 23/87	18 :51	1272	186	12	1933	JAN 15/88
327	NOV 23/87	20 :10	1272	182	81	1934	JAN 15/88
327	NOV 23/87	20 :26	1272	181	138	1935	JAN 15/88
327	NOV 23/87	20 :41	1272	180	106	1936	JAN 15/88
327	NOV 23/87	20 :57	1272	178	24	1937	JAN 15/88
327	NOV 23/87	21 :13	1272	177	42	1938	JAN 15/88
327	NOV 23/87	21 :28	1272	178	30	1939	JAN 15/88
327	NOV 23/87	21 :44	1272	178	39	1940	JAN 15/88
327	NOV 23/87	22 : 0	1272	179	100	1941	JAN 15/88
327	NOV 23/87	22 :31	1272	177	143	1942	JAN 15/88
327	NOV 23/87	22 :47	1272	176	146	1943	JAN 15/88
327	NOV 23/87	23 : 3	1272	173	11	1944	JAN 15/88
327	NOV 23/87	23 :34	1272	165	29	1945	JAN 15/88
327	NOV 23/87	23 :50	1272	171	87	1946	JAN 15/88
328	NOV 24/87	0 : 6	1272	173	2	1947	JAN 15/88
328	NOV 24/87	0 :37	1272	176	1547	1948	JAN 15/88
328	NOV 24/87	0 :52	1272	171	91	1949	JAN 15/88
328	NOV 24/87	1 : 8	1272	170	20	1950	JAN 15/88

328	NOV 24/87	1 :24	1272	176	47	1951	JAN 15/88
328	NOV 24/87	1 :39	1272	173	7	1952	JAN 15/88
328	NOV 24/87	1 :55	1272	178	76	1953	JAN 15/88
328	NOV 24/87	2 :27	1272	182	130	1954	JAN 15/88
328	NOV 24/87	2 :42	1272	186	81	1955	JAN 15/88
328	NOV 24/87	2 :58	1272	194	57	1956	JAN 15/88
328	NOV 24/87	3 :14	1272	192	15	1957	JAN 15/88
328	NOV 24/87	3 :29	1272	192	68	1958	JAN 15/88
328	NOV 24/87	4 : 1	1272	189	69	1959	JAN 15/88
328	NOV 24/87	4 :32	1272	193	37	1960	JAN 15/88
328	NOV 24/87	4 :48	1272	192	34	1961	JAN 15/88
328	NOV 24/87	5 : 3	1272	190	54	1962	JAN 15/88
328	NOV 24/87	5 :19	1272	192	54	1963	JAN 15/88
328	NOV 24/87	5 :34	1272	194	30	1964	JAN 15/88
328	NOV 24/87	5 :50	1272	195	60	1965	JAN 15/88
328	NOV 24/87	6 :22	1272	201	90	1966	JAN 15/88
328	NOV 24/87	6 :37	1272	204	52	1967	JAN 15/88
328	NOV 24/87	7 : 9	1272	207	12	1968	JAN 15/88
328	NOV 24/87	7 :24	1272	213	118	1969	JAN 15/88
328	NOV 24/87	7 :56	1272	214	137	1970	JAN 15/88
328	NOV 24/87	8 :12	1272	211	14	1971	JAN 15/88
328	NOV 24/87	8 :27	1272	156	92	1972	JAN 15/88
328	NOV 24/87	9 : 3	1412	211	9	1973	JAN 15/88
328	NOV 24/87	13 :52	1412	194	30	1974	JAN 15/88
343	DEC 9/87	5 :16	1412	204	105	1975	JAN 15/88
343	DEC 9/87	8 :10	1412	197	91	1976	JAN 15/88
343	DEC 9/87	22 :40	1412	213	50	1977	JAN 15/88
343	DEC 9/87	23 :27	1412	216	97	1978	JAN 15/88
344	DEC 10/87	5 :14	1412	197	81	1979	JAN 15/88
344	DEC 10/87	5 :41	1272	92	33	1980	JAN 15/88
344	DEC 10/87	5 :57	1272	123	104	1981	JAN 15/88

APPENDIX 7 (CONT.)

RADIOTELEMETRY CONTACTS
PICKERING EAST

JULIAN DAY	DATE	TIME	RADIOTAG FREQUENCY	TEMP. (C)	VARIANCE	DATA LINE NUMBER	DATE OF DATA TRANSFER
282	OCT 9/87	18:24	50.289	17.3	20	1	OCT 13/87
282	OCT 9/87	18:31	50.287	17.3	7	2	OCT 13/87
283	OCT 10/87	17:43	50.287	9.0	3	200	OCT 13/87
283	OCT 10/87	17:43	50.289	9.0	33	201	OCT 13/87
284	OCT 11/87	08:28	50.287	7.3	42	400	OCT 13/87
284	OCT 11/87	08:28	50.289	7.3	39	401	OCT 13/87
285	OCT 12/87	04:14	50.287	8.9	29	600	OCT 13/87
285	OCT 12/87	04:14	50.289	8.9	14	601	OCT 13/87
285	OCT 12/87	23:42	50.289	8.9	86	800	OCT 13/87
285	OCT 12/87	23:50	50.287	8.9	29	801	OCT 13/87
286	OCT 13/87	11:24	50.289	11.3	37	950	OCT 13/87
286	OCT 13/87	11:32	50.289	10.7	17	951	OCT 13/87
286	OCT 13/87	13:36	50.289	12.0	11	965	OCT 13/87
286	OCT 13/87	13:44	50.289	12.6	29	966	OCT 13/87
304	OCT 31/87	19:49	50.253	9.5	29	1227	NOV 2/87
304	OCT 31/87	19:49	50.255	9.5	13	1228	NOV 2/87
304	OCT 31/87	20:00	50.253	9.5	29	1229	NOV 2/87
304	OCT 31/87	20:00	50.255	9.6	50	1230	NOV 2/87
310	NOV 6/87	23:18	50.414	18.2	198	1231	NOV 9/87
311	NOV 7/87	00:05	50.412	19.3	62	1232	NOV 9/87
312	NOV 8/87	07:42	50.412	13.5	171	1233	NOV 9/87
328	NOV 24/87	09:13	50.272	14.7	25	1234	NOV 24/87
328	NOV 24/87	09:28	50.272	14.6	11	1235	NOV 24/87
328	NOV 24/87	10:00	50.272	14.4	11	1236	NOV 24/87
328	NOV 24/87	10:15	50.272	14.1	70	1237	NOV 24/87
328	NOV 24/87	13:08	50.272	13.7	47	1248	NOV 24/87
328	NOV 24/87	13:23	50.272	13.6	0	1249	NOV 24/87
332	NOV 28/87	14:35	50.274	3.8	67	1440	NOV 30/87
344	DEC 10/87	10:14	50.272	15.5	257	1441	JAN 4/88
344	DEC 10/87	10:30	50.272	11.9	34	1442	JAN 4/88

DCC REMOVED, PLACED AT PK A STATION, JAN 4/88